

# FINAL REPORT

## EVALUATION OF US MILITARY AMT TRAINING AND EXPERIENCE AND ITS APPLICABILITY TO CIVIL QUALIFICATION AND CERTIFICATION REQUIREMENTS

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### 1.1 EXECUTIVE SUMMARY

The United States Armed Forces have been a major source of Mechanics/**AMTs** (Aviation Maintenance Technicians) for the civil aviation industry from its beginnings. There is a need to provide more **A&P** (Airframe and Powerplant) certificated AMTs to meet the growing shortage in civil aviation. In recent years, the process of qualifying military personnel to become FAA A&P certificated has not been maintained nor updated. The FAA did not always have current Military Occupation Specialty Code (MOS, AFSC, Rate) information. This made it increasingly difficult for the Flight Standards District Offices (**FSDOs**) to issue authorization for military personnel to take certification testing based upon their military experience. The perception of both the FAA and the civilian aviation community was that military aviation maintenance had become very specialized in both training and personnel assignments. None of the military services had taken definitive action to change this impression or to provide current occupational code information for the FAA. Though attempts were made in the past to remedy the situation by developing an all branch military experience/qualification process for A&P certification, none were successful.

When the Notice of Proposed Rule Making (**NPRM**) for the proposed Part 66 (dated July 9, 1998), Qualification and Certification of Aviation Maintenance Technicians was reviewed by the US Air Force Headquarters team they found no mention of qualification procedures for military personnel. They responded to the **NPRM** with comments addressing what they felt was an oversight. As a result of the comments, and subsequent meetings with FAA AFS 300 (the Continuous Airworthiness Maintenance Division), positive action was taken. A development team ("Tiger Team") under the leadership of the US Air Force, was formed with representatives from all military services, civil aviation, and FAA representatives from AFS 300. The team's mission was to develop and put a program in place that would both correct the current situation and establish a system that will maintain a consistent A&P certification program for all military personnel. To help ensure that the effort would be successful, the FAA

participated by developing a strategic plan to support the Team's activities. To facilitate the process, a contractor was selected to conduct research and assist in the development of the program.

The objective of the project was to first review the current process of military aviation maintenance personnel training and work assignments. The next step evaluated the military's programs to determine which ones met the FAA requirements for their maintainers to become FAA certificated as Airframe and Powerplant (A&P) (or in some cases Airframe or Powerplant) Certificated Mechanics. This evaluation was based upon the related experience section of Part 65, Subpart D-Mechanics, section 65.77, Experience Requirements. The desired project outcome is for the FAA to accept and implement a validated, objective, consistent, and streamlined joint FAA-Military program for qualifying military personnel to become A&P certificated. It is a program based on processes that are continuously monitored by an all-military services/FAA council, which will maintain control and make revisions as necessary.

The project was officially underway by late April of 1999 and will be considered complete when the FAA renders final acceptance of the program described and defined in this document. The FAA and each service branch supported their representatives on the team and the associated development work necessary to prepare the program's training/experience matrix documentation.

Team visits to several major military aviation maintenance training sites were conducted. These visits proved to be quite valuable. The team was able to establish that the training provided for all military maintainers is excellent. Military personnel learn with state-of-the-art training systems, processes, and equipment. Military training continually meets, and often exceeds, the requirements and standards of the civilian aviation industry.

Though there is still specialization in both military maintenance training and personnel assignments, there is significantly less than there was prior to the mid/late 1980's. Because of the reduction in force and the mission/readiness requirements of today's military, cross utilization of staff has become the rule. Current military operations require people who are highly skilled and who can work together in teams. Though an aviation maintainer may have a specific technical specialty or be initially trained on a specific aircraft, performing tasks outside one's basic assignment is the norm.

In addition to the current method of A&P certification knowledge testing at FAA designated commercial testing sites, the military has undertaken steps to provide an additional testing source. This element of the program entails some initial fixed costs to be funded by the military, estimated at about \$220,000, for a secure FAA testing file server and associated programming. This will allow the FAA to provide the required A&P Knowledge Tests free of charge to all military personnel at all military testing sites worldwide through the Defense Activity for Non-Traditional Education Services (DANTES). In the future, it will be possible for DANTES to provide all 62 FAA knowledge tests to military personnel with minor additional cost. There will be minimal fixed costs for the military to administer and maintain the program. The Army, Navy/Marines and the Coast Guard will be able to handle program administration using existing staffing and administrative systems. The Air Force, due to their relative size and larger numbers of maintainers, will add two full-time equivalents to the Community College of the Air Force staff at Maxwell AFB, Alabama. Any of these support requirements may be adjusted as experience is gained with the program. The FAA, on the other hand, will experience a significant amount of incremental Aviation Safety Inspector (ASI) manpower savings, due to the reduced complexity of this program over the current military interview/qualification verification process. Though given a high degree of emphasis by the military, the DANTES alternative testing provision is not required for this program to move forward.

The program in and of itself is simple; its administration varies in complexity depending upon service branch. The FAA workload should be reduced since the program will require less Inspector time to administer. Each military participant will be provided by their service branch with an individualized document (*FAA Certification Performance of Job Tasks* - Form CG-G EAE-2) that is both a required task completion guide (matrix) and sign-off sheet. Upon completion of the program and validation of all signed tasks, an official *Certificate of Eligibility* will be issued by the participant's service branch. Once the program is in place, a military maintainer may take his/her validated and signed *Certificate of Eligibility* to any FAA Flight Standards District Office (**FSDO**), complete the appropriate FAA Airmen's Application form, and become authorized by an FAA Aviation Safety Inspector to complete A&P or A or P certification testing without further evaluation by the FSDO inspector.

This program will provide a method that ensures that the personnel enrolled in the program will be credited only for appropriate experience and training... one that provides an audit trail for any oversight requirements. Both FAA regulations and the Uniform Code of Military Justice ensure discipline within the program. To ensure that future Federal Aviation Administration (FAA) decisions/policy changes, affecting the A&P certification process, include military participation/involvement, the **Joint Service Aviation Maintenance Technician Certification Council (JSAMTCC)** has been established to work closely with the FAA. No changes to this program, its training and experience requirements, record-keeping and sign-off system, administrative procedures, or documentation can be changed without the approval of the Council.

This is a win-win program. The military services win by providing both a pathway for aircraft maintenance personnel to enhance their knowledge and gain a technical certification that is recognized around the world, in addition to providing significant recruitment and retention incentives. The FAA benefits by having in place a validated qualification program for military maintainers to become A&P certificated, a program that reduces FAA workload to administer and oversee. The aviation industry wins with an increased supply of experienced A&P certificated technicians available as they complete active duty requirements or retire from the military.

## 1.2 INTRODUCTION

The primary objective of the project was to determine applicability of current military training and experience based upon the requirements of Parts 65 and 147 Aviation Maintenance Technician Schools (AMTS). This was accomplished by building a comparative matrix for each service branch based on the 128 curriculum topic requirements in Part 147. Given that current military aviation does not encompass all of the topics required, specific courses (bridge training) have been, or will be developed by the military to fill the training/experience shortfalls on an individual basis. Using these matrices, any military aviation technician may have his/her individual training and experience evaluated by the responsible branch organization. With input from them, individuals will be able to assess their current qualification status, then develop a specific training and experience plan to become qualified for A&P certification testing.

Each military branch will submit current aviation maintenance occupation (so called "MOS", "Ratings", "NEC", or "AFSC" categories) descriptions to the FAA. There will also be a system put in place that ensures the FAA is notified of any changes to occupation descriptions, or their alpha-numeric codes, for appropriate document updates.

The secondary objective was to develop a program with all military service branches that would provide a documented pathway for military maintainers to gather their service training and experience into a

uniform format that can be recognized and accepted by the FAA. This system will have strict verification and sign-off requirements. Senior enlisted and maintenance officer personnel will validate all signed entries. Since all entries are based upon the comparative matrices discussed earlier, the FAA can easily audit the whole program or any single individual's records at any time.

## 1.2.2 Meeting the FAA Requirements

The team wanted to establish the most practical and useful ways to meet the FAA's standards for establishing qualifications to become A&P certificated. They found that a good deal of work had been done in the past and had not been discarded. It was also established that the US Coast Guard had developed a process acceptable to the FAA for qualifying their AMTs to take certification testing. It was apparent that processes developed in the past could easily be adapted to meet the intent of this new program. Using this information, it was agreed to develop a program that would meet the requirements of CFR 14, Part 65, Sub section 65.77 Practical Experience Requirements:

*Each applicant for a mechanic certificate or rating must present either an appropriate graduation certificate or certificate of completion from a certificated aviation maintenance technician school or documentary evidence, satisfactory to the Administrator, of—*

- a.) At least 18 months of practical experience with the procedures, practices, materials, tools, machine tools, and equipment generally used in constructing, maintaining, or altering airframes, or powerplants appropriate to the rating sought; or*
- b.) At least 30 months of practical experience concurrently performing the duties appropriate to both the airframe and powerplant ratings.*

Military aviation maintenance training and work experience has been generally accepted by the FAA as credit toward all or part of the requirements to qualify personnel for eligibility to become FAA Airframe and Powerplant (A&P) certified. This has been accomplished through FAA rule, CFR 14, Part 65, Sub section 65.77 of this rule requiring that applicants must have "documentary evidence satisfactory to the administrator." The regulation is quite clear as to minimum experience requirements necessary to qualify for mechanic certification testing.

The current process of documenting applicable experience, so that military personnel qualify to take A&P knowledge and oral/practical examinations, is not consistent between service branches. Further, there are differences in acceptance levels of military experience for A&P certification between FSDOs and also between individual Aviation Safety Inspectors (ASIs). Much of the information on military occupations and career fields is outdated. This can cause the ASIs in the field to be inconsistent and have difficulty in accessing the experience and qualifications of military personnel against the minimum requirements of Part 65. The experience documentation and validation process has not been updated or maintained during the past several years and is in need of review and significant revision. Attempts to accomplish this have been started over the last ten years, but none of these have come to a successful conclusion.

The overriding objective of this effort was to build a verification of experience and training process that will meet or exceed all requirements of Part 65 and any future modifications to this rule. The program will also provide documentation that is the same for all military aviation maintenance personnel. The same document(s) will be provided to all FSDOs, eliminating any guesswork or confusion for individual Aviation Safety Inspectors. With the integrity built into this program, FAA personnel can rest assured that when a military person requests authorization for testing to become A&P certificated, they have met or exceeded the minimum qualification requirements.

## 1.3 MILITARY AVIATION MAINTENANCE TECHNICIANS

With the elimination of a mandatory military obligation and the end of the Cold War, there have been significant changes in the “all volunteer” Armed Forces of the United States. Some of the most substantive changes have been in military aviation maintenance. Starting with the end of the Vietnam era, there has been almost a continual reduction in the numbers of aircraft and maintenance personnel. The former method of deploying high levels of narrowly-focused specialists has been eliminated. A more “generalist” based concept for maintenance technicians was adopted. Specialization still exists in the military, however, they generally parallel the specialties within civil aviation. Military specialties are primarily for structures repair, electronics (avionics and electronic warfare systems), shop level engine repair and overhaul, non-destructive testing, and certain component shop “bench work” on complex line replaceable units (LRUs).

All service branches have specific fitness requirements for personnel who select aviation maintenance career fields. All require at least high school graduation as a minimum standard. Prior to career field assignment, applicants are tested for both mechanical and electrical aptitude and must meet specified academic test score minimums. Persons who do not qualify are rejected and may be accepted in a less-demanding career field. Aviation maintenance training is too complex, lengthy, and costly to risk assigning anyone who does not have the minimum knowledge and skills required to achieve success. Even with initial testing and screening, not all selected candidates graduate into aviation maintenance careers.

Though the various service branches have different missions, all military entrants experience similar initial training. First, there are the eight to ten weeks of so-called “basic training” or “boot camp.” This is where new recruits learn the basic skills common to all military personnel, including mental and physical conditioning. Upon completion of this basic individual training, the graduates are assigned to Advanced Individual Training (AIT). Aviation maintenance is one of, if not the most, complex and lengthy of all AIT career fields. Personnel who enter this field will have spent from eight months to over one year in training before they reach their first actual duty assignment. The cost conscious military is careful with the selection process before making the required training investment.

Typically, each service starts their maintenance personnel training with a basic aviation maintenance skills program. This is most often referred to as “A” School. All trainees attend similar programs that include fundamentals of aviation, tools and tool use, standard maintenance processes, practices and procedures, safety and human factors, chemicals, fuels, ground handling, winter operations, and other “standard tasks/practices”. Added to this are the special mission requirements for each branch. After completing primary or basic skills training, the trainees are assigned to specific aircraft type or specialty skills training. Credit for experience under Part 65.77, will not start until the program participant enters “A” School. The section that follows, *Military Aviation Maintenance Training*, defines how the individual service branches approach initial and advanced maintenance training.

Training is a continuing process for military AMTs. Generally, when entering the second enlistment period or gaining the rank equivalent to level “E-5,” AMTs begin attending advanced training programs that continue with higher rank and increased levels of responsibility. This training is both MOS/AFSC/Rate related along with advanced technical skills, inspection and non-destructive testing, quality control, shop/flightline management, and supervisory subjects.

The services also encourage their enlisted personnel to complete higher education during their off-duty time. In most cases, advancement beyond the rank of E-6 is increasingly difficult to achieve without at least some college or an Associate in Science or Associate in Arts degree. This education is offered with tuition assistance, on base, off base, and over the Internet. Many service members above the rank E-6

will have two-year college degrees. A significant number of senior enlisted AMTs have Bachelor of Science or Bachelor of Arts college degrees. Many senior Non Commissioned Officers go on to achieve their master's degrees while on active duty. *Note: The Coast Guard is an arm of the Department of Transportation and does not have all of the amenities described for branches under the Department of Defense in the above paragraph.*

Senior enlisted personnel, grades E-7 through E-9, attend Senior Enlisted Academies where they learn team building, statistical quality control, state-of-the-art business and management practices, and leadership/management skills. They also attend advanced technical courses related to their MOS/AFSC/Rating career paths; these include maintenance program management, and maintenance operations leadership subjects.

The United States Armed Forces produce highly qualified and professional AMTs. Their training is high quality and continues from the first to the last days of service. The National Guard and Reserves, though not full-time active duty personnel, are provided the same training and development opportunities as full-time active duty personnel.

## **1.4 MILITARY AVIATION MAINTENANCE TRAINING**

During the development of this project, training overview and evaluation visits were conducted at all service branch's primary maintenance training facilities. These visits were designed to showcase all levels of maintenance training for the FAA, civil aviation maintenance leaders, and other military team members. Each visit was conducted to give the attendees, including FAA representatives, a full picture of training activities in an operational (nothing staged, students in normal session) environment.

The team also visited hangars, shops, repair centers, and flight line operations on an unannounced basis. This enabled the group to observe actual maintenance being performed, as well as on-the-job (OJT) training in progress. These observations served to assure the group that military aviation maintenance meets minimum civil standards and is congruent with commercial airline maintenance practices.

### **1.4.1 US Air Force - Luke AFB, Arizona - January 26-28, 1999**

The United States Air Force took the initial leadership role in this effort. They have retained this position given that they have the largest population of military aircraft maintainers and the widest range of aircraft and training courses. The first maintenance training review visit was held at Luke AFB in Arizona. This is the headquarters for one of the largest fleets of aircraft in the Air Force inventory, the F-16 Fighting Falcon. Since the team was scheduled to visit other sites where initial, entry level, aviation maintenance processes and practices are learned; evaluation of F-16 maintenance training was a logical starting point.

The Air Force aviation maintenance training model is very similar to that of the other service branches described in this section. Personnel entering the service are tested and screened prior to being selected for aviation maintenance. This is done to ensure that those selected have the backgrounds required to successfully complete the training. After service entry, or basic training, selected personnel are sent through general course work that teaches the elementary and basic knowledge and skills required for all aircraft maintainers. This is done at the Air Force Training Center at Sheppard AFB in Wichita Falls, Texas. Most members of the team have visited this facility and agree that it is of the highest standard. When the preliminary training is completed, individuals move to advanced training that is aircraft-type and/or special-skill specific.

The F-16 maintenance training program covers the full range of the aircraft's learning requirements. Crew chiefs (airplane general technicians), powerplant, phase dock, structures repair, and avionics technicians are all trained in the same facility ("school house"). State-of-the-art training including: electronic learning materials, computer based and specific task devices, and a significant amount of actual aircraft and equipment, is used throughout the training process. Trainees are held to high-performance standards, are frequently tested, and are required to demonstrate competency before moving forward.

Upon graduation from formal training, though assigned to operational units, the graduates are entered into 15 months of formal, supervised, on-the-job training. The unit is required to consider the Airman and apprentice until the OJT has been successfully completed.

As individuals gain experience, time in service and advancement in rank, they are required to get further and more advanced training. This training covers both more maintenance knowledge and skills, along with the leadership and management requirements of higher rank and its incumbent responsibilities. The Air Force also operates the fully accredited Community College of the Air Force (CCAF). Personnel who wish to advance in rank must take college level courses on their own time through the CCAF program. Any Air Force enlisted person that plans to move beyond the rank of E-5 is highly encouraged to complete an associate degree within their specific career field.

Air Force maintenance training is comparable to any civil aviation maintenance training being offered today. It meets or exceeds civilian standards and those required by the FAA.

#### **1.4.2 U.S. Navy/Marine Corps - NAMTRAGRUDET, Jacksonville NAS, FL - June 9-10, 1999.**

The United States Navy did an excellent job of showing the team their aircraft maintenance training programs and processes at NAS Jacksonville. The US Navy and the Marine Corps are one and the same in their aviation programs, known as "NAVAIR." Thus Marine and Navy personnel are trained side by side. Their system is very impressive, using the latest electronic learning technology mixed with some of the finest fully operational aircraft system mockups and trainers in existence today. The Navy's new electronic training and personnel records system, under the final stages of development, will be one of the best the military has to offer.

Navy/Marine personnel attend their basic aviation "A" school at NAMTRAGRU in Pensacola, Florida. The facility is exceptional in every way. The training buildings and dormitory facilities are new and built to high standards to achieve maximum-learning efficiency. The students learn on modern, up-to-date, aircraft and systems supplemented with the latest in electronic learning systems and courseware. The Navy facility is of the same high standard as the Air Force's facilities at Sheppard AFB at Wichita Falls, Texas.

Due to the Navy's sea deployment requirements, there is more formal "school house" training and less formal training at remote bases compared to the other military branches. Naval mechanics, though initially trained within broad skill specialties, are cross-trained (OJT) in the field to do the majority of aircraft maintenance tasks. It is common for metal smiths to change engines and work on landing gear and for electrical and avionics personnel to do the same. The same sort of cross-utilization and training is common in all aspects of Navy/Marine aircraft maintenance. This is true, since during sea deployment and often at shore bases, there are not enough sailors and/or marines to effectively operate without cross-utilization of technicians. The Navy, along with the other service branches, has moved away from strict specialization to more generalist maintainers, with focused initial training. The introduction of stand-alone computer based training, deployed on land and at sea, allows mechanics to cross-train and study for



advanced qualification testing during their off duty hours. The Navy's training system, as with the Air Force, is similar and equal to civilian industry training.

### **1.4.3 U.S. Coast Guard Aviation Technical Training Center, Elizabeth City, NC - July 27, 1999**

The United States Coast Guard is the smallest of the military branches and is an arm of the Department of Transportation, not the DoD. The total number of Coast Guard AMTs is about 1,665 enlisted personnel. The Coast Guard's maintenance training operations are all conducted at the Aviation Technical Training Center in Elizabeth City. It is also their major overhaul maintenance depot site for the 220-unit fleet of search and rescue, law enforcement, and drug traffic interdiction aircraft. The Coast Guard Aviation Technical Training Center is designed to be as similar to a Part 147 AMT School as possible. There are two basic courses for Coast Guard aviation maintenance technicians: 1. Aviation Maintenance Technician – A near direct parallel of the Part 147 A&P curricula, excluding non-Coast Guard technology subjects (no reciprocating engines nor wood/fabric airframes, etc.) 2. Aviation Electronics Technician – This course shares the same aviation maintenance basics as the AMT, then focuses on the electrical, electronic, and avionics elements of aircraft maintenance. The Training Center also conducts advanced AMT "C" schools for jet engine teardown/inspection, advanced electrical troubleshooting, and major airframe inspections. The Coast Guard uses highly sophisticated electronic systems not only for aircraft navigation and auto flight guidance, but also for search and rescue and drug interdiction operations. Normally, within the first 24 months after completion of their initial courses, personnel return to Elizabeth City for additional advanced skills "C" school training.

The Coast Guard employs the latest electronic learning technology mixed with outstanding, fully operational aircraft system mockups and trainers. Their avionics/aircraft electronics training is among the best in the world. On-the-job training continues at the individual duty stations. In their daily operations, due both to their size and widely deployed assets in small stations, this service requires maximum cross-utilization of AMT's. The Coast Guard technician's work is almost identical to civil aviation. Comparing the USCG to all the other service branches, transitioning of their maintainers to A&P certification will require the least amount of additional training and/or experience.

### **1.4.4 U.S. Army Aviation Training Command, Ft. Eustis, VA – July 28 - 29, 1999**

The United States Army's maintenance training program is focused upon trainees becoming qualified to maintain a specific aircraft type or specific aviation maintenance specialty. There are basic aircraft maintenance courses, further broken down by aircraft or powerplant type. Major career fields are Aircraft Mechanic (Crew Chief), Powerplant Mechanic, Structures Mechanic, Powertrain Mechanic, and Armament Mechanic (this specialty also includes the aircraft electronics/avionics skills).

Army maintenance training is comparable to the other service branches. All state-of-the-art electronic learning systems are employed, along with a heavy emphasis on hands-on training. Since Army aircraft are primarily helicopters, they are more easily used in the training environment. Active, operational helicopters are utilized while in transit to depot or heavy maintenance visits. This practice allows the "school house" access to current operational equipment for training purposes at all times.

The Army's structures repair courses are outstanding. Due to the battlefield operations for which Army Aviation must prepare, the ability for maintainers to be able to perform complex metal and composite



structures repair in the field is essential. Thus, the training requires a high degree of skill, mixed with the ability to complete tasks quickly and correctly. The fall out rate from this training is higher than most. A person who does not display the required competencies is placed where a lesser degree of precision and dexterity is required.

After the initial “school house” training, the soldiers go to operational units where on-the-job training and experience is gained. As soldiers gain time in service and advance in rank, additional training and experience, they return to the “school house” for more advanced technical training mixed with training in leadership and supervisory duties. Army maintenance training clearly meets the standards of civil training. The trainers at Ft. Eustis estimate the normal period required for an enlisted technician to gain sufficient experience to qualify for A&P certification is more than four and can be up to six years.

## **1.5 MILITARY EXPERIENCE AND TRAINING COMPARED TO FAA REQUIREMENTS**

Working with FAA representatives from AFS 340, AFS 600, the Scottsdale, AZ FSDO, and the Long Beach, CA FSDO, a set of “bridge training” program requirements were developed by the team. Using Part 147 subject items (appendix B, C, and D) as guidelines for basic knowledge and skill requirements, it was determined that, although the military will be qualifying on the basis of experience as required in Part 65.77, not all subjects and experience required of civil applicants were provided for most military personnel. These subject areas are:

- Airframe/powerplant conformity & airworthiness inspection
- Carburetors & induction systems
- Civil maintenance publications
- Corrosion control
- Engine run
- FAA regulations, maintenance forms and records
- Fluid lines and fittings – make & install flexible/rigid lines
- Reciprocating engines
- Propellers
- Weight and balance – weigh aircraft
- Welding
- Wood structures & aircraft covering

To assure greater congruence between civil and military training, new training course work was designed to bridge the gaps in training and supplement experience areas that are marginal. The basis of this training requirement is an Airframe and Powerplant Qualification Training Plan (QTP) developed by the Air Force 367th TRSS at Hill Air Force Base, UT. This QTP describes, in detail, the courses that must be completed to meet the bridge training requirements. Each service branch will adapt individual QTPs for specific MOS/AFSC/Rate categories, assigning appropriate formal training and/or additional on-the-job training to augment what is not provided. The group agreed that, in most cases, hands-on training would not be required in subject areas such as carburetors, reciprocating engines, and propellers. The hands-on skills required for these subjects are considered basic; they are taught during military training and acquired from on-the-job experience that readily transfers.

## 1.5.1 “Bridge Training” Program and Coursework

The joint FAA/DoD A&P program development team agreed upon the required courses, including the basic teaching/learning processes to be used. The team recognized that the course work exceeds the minimum requirements of Part 65.77, but agreed that meeting the intent of the Part 147 curriculum would be beneficial for the program participants. Each course developed will be based upon the Air Force Career Development Course (CDC) format. A sample CDC is shown in **Attachment #4**. Thus, each course will have an individual CDC. Though the Air Force will prepare these CDCs, once developed and adopted by the group, they can only be changed by the Joint Service Aviation Maintenance Technician Certification Council (JSAMTCC). Specific information on the JSAMTCC can be found in Chapter 1.7 of this report.

Bridge Training will be required based upon the individual program participant’s training and experience of record. For example, a military AMT who has attended the Lockheed C-130 Crew Chief level training program may not be required to take the “bridge” propeller course. On the other hand, many of the “bridge” courses are mandatory for all participants, regardless of military training and experience. Following is a list of those courses, the method of training and delivery media, and any variable enrollment requirements:

### **1.5.1.1 Airframe and Powerplant Development Course**

All participants will be required to complete this course, which is based upon Part 43.13 Maintenance, Preventative Maintenance, Rebuilding, and Alterations, including the contents of AC 43-13-1B: *Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair*. Also included as text materials are AC 65-9A *Airframe and Powerplant Mechanics General Handbook*, AC 65-12A *Powerplant Handbook*, and AC 65-15A *Airframe Handbook* that provide the knowledge set for the full range of aircraft systems along with the procedures, processes, and practices required to properly maintain them. The current CDC defines this course as text based (paper) with appropriate review and testing requirements. Future plans are to develop the program as Computer-Based Training (CBT) and to make it available either on-line or as a CD-ROM, again with appropriated review and testing requirements.

### **1.5.1.2 Introduction to FAA Rules/Regulations**

The team developed an outline of specific rules and regulations required to be an effective A&P. Since no existing course was found that covered the subject materials, CDCs have been written to cover each regulation and topic listed below. Included in the coursework is the *Airframe/Powerplant Conformity & Airworthiness Inspection* training requirement. The course will initially be paper-based and/or released on CD-ROM. As experience is gained with this course and feedback is reviewed, it will be considered for development into a CBT program with on-line availability.

**Title 14 Code of Federal Regulations (CFR)** All Federal Aviation Administration (FAA) rules and regulations are contained in the CFR

- General knowledge of CFR 14 contents

**Part 1** – Definitions and Abbreviations

- Existence of Part and use of FAA terminology

**Part 11** – General Rulemaking Procedures

- Existence of Part, reference, individual impact of individual participation through Notice of Proposed Rule Making process

**Part 13** – Enforcement

- General knowledge of contents
- Specific 13.21: Military and Civilians under the UCMJ

**Part 21** – Certification of Aircraft Parts

- General knowledge of contents
- Part 23** – Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Aircraft
  - Ten occupants or less
- Rule overview
- Part 25** - Airworthiness Standards: Transport Category Aircraft
  - Rule overview
- Part 27** - Airworthiness Standards: Normal Category Rotorcraft
  - Rule overview
- Part 29** - Airworthiness Standards: Transport Category Rotorcraft
  - Rule Overview
- Part 39** – Airworthiness Directives
  - Rule Overview
- Part 43** – Maintenance, Preventative Maintenance, Rebuilding, and Alteration
  - CDC and course will provide necessary information
  - Appropriate forms, including the 337, will be covered
- Part 65** – Certification of Airmen Other Than Flight Crew Members: Sub Part D-Mechanics
  - AC 9A, 12A and 15A covered by CDC and course
  - General knowledge of rule, qualification, certification requirements, privileges and limitations
  - Inspection Authorization (IA): requirements, privileges, and limitations
- Part 91** - General Operating and Flight Rules (General Aviation)
  - General overview of the rule
  - A&P requirements, maintenance standards, limitations, and privileges
- Part 121** – Certification and Operations: Domestic, Flag, and Supplemental Air Carriers and Commercial Operations of Large A/C
  - Rule overview
  - AMT requirements, maintenance standards, limitations, and privileges
  - Air Carrier General Maintenance Manual (GMM)
  - Minimum Equipment List (MEL)
  - Configuration Deviation List (CDL)
  - Training & qualification requirements (Individual Airline GMM and 121.375)
  - Duty time limits (121.377)
- Part 135** – Air Taxi Operators and Commercial Operators
  - Rule overview
  - AMT requirements, maintenance standards, limitations, and privileges
  - Training & qualification requirements
  - Duty time limits
- Part 145** – Repair Stations
  - Rule overview
  - Mechanic requirements, maintenance standards, limitations, and privileges
  - Repair Station ratings system
  - Mechanic/Repairman qualifications requirements and training records
  - Individual Repair Station Manuals
  - Air carrier (121) repair station joint responsibility, job documentation, use of manuals/procedures (following the individual/required manuals, procedures, processes)
- Part 147** – Aviation Maintenance Technician Schools
  - Rule Overview
  - Certification Requirements
  - Credit for previous training

Air Transport Association of America (ATA) Specification 100 will also be introduced. The participants will be taught basic knowledge of the ATA 100 systems and subsystems in order to

understand the transport category aircraft documentation numbering system. Introduction to non-ATA maintenance manuals and technical publications will also be provided. This element will cover other civil aviation maintenance publications requirements.

#### **1.5.1.3 Air Transport Fundamentals (Provided by Delta Airlines)**

Delta Airlines developed a computer-based training program, delivered on CD-ROM that covers all the primary and essential knowledge required for AMTs in Air Transport Operations. This program is used as an introductory course during their initial orientation program for all new hire and/or job transfer entrant AMT personnel. This program will be an elective for the Coast Guard and required for all other military A&P program participants. It has been redeveloped by the USAF 367<sup>th</sup> TRSS based upon a CDC that includes knowledge testing prior to awarding completion credit.

#### **1.5.1.4 Carburetors & Induction systems**

These systems are taught in the *Airframe and Powerplant Development Course*. The hands-on performance requirement of this element is satisfied by other fuel injection and distribution systems tasks performed by military AMTs. The team agreed that “skills transfer” from similar work satisfies the requirement.

#### **1.5.1.5 Corrosion Control**

The FAA Corrosion Control video training program, prepared as part of the Aging Aircraft Program, was developed into a course for all program participants. The USAF 367th TRSS has developed a new corrosion control CBT program for stand-alone or on-line delivery, complete with course testing to ensure competency.

#### **1.5.1.6 Engine Run**

The US Navy’s P-3 Orion (4 engine submarine patrol/warfare aircraft) CBT program and other video and CBT materials have been developed as a stand alone or on-line CBT course by the USAF 367th TRSS.

#### **1.5.1.7 Fluid Lines and Fittings – Make & Install Flexible/Rigid Lines**

These requirements are taught in the *Airframe and Powerplant Development Course*. The hands-on performance of these tasks is an OJT requirement, part of the QTP for any military AMT who does not accomplish them during regular duty assignments.

#### **1.5.1.8 Reciprocating Engines**

Basic reciprocating engine theory and operation is well covered in the *Airframe and Powerplant Development Course*. Video and CD-ROM materials from International Aviation Publishers and other sources have been developed into a CDC and a CBT on-line program and are currently under development by the USAF 367th TRSS. The hands-on performance requirement of this element is satisfied by turbine engine and powerplant system related tasks performed by military AMTs. The team agreed that “skills transfer” from such similar work satisfies the requirement.

#### **1.5.1.9 Propellers**

The US Navy’s P-3 Orion (4 engine submarine patrol/warfare aircraft) video and CD-ROM learning materials are being developed into appropriate CBT by the USAF 367th TRSS. These materials, along with others on hand from International Aviation Publishers and manufacturers, will be blended together as a propeller maintenance course available as CBT on-line.

#### **1.5.1.10 Weight and Balance and Weigh Aircraft**

The principles are covered in the *Airframe and Powerplant Development Course*. Participating in weighing of aircraft is an OJT requirement, part of the QTP for any military AMT who does not perform weight and balance during regular duty assignments.

#### **1.5.1.11 Welding**

The principles of welding, types of welding and weld quality are covered in the *Airframe and Powerplant Development Course*. The QTPs require examination, inspection, acceptance and/or rejection of welds as an OJT element.

#### **1.5.1.12 Wood Structures and Aircraft Covering**

The elements of Wood Structures and Aircraft Covering are covered in the *Airframe and Powerplant Development Course*. The CDCs are based upon learning objectives classified as level one in Part 147 for these subjects. The participants will be provided with the same level of training in this area as Part 147 AMT school students.

## **1.6 THE JOINT SERVICE'S CHARTERED ORGANIZATION**

During 1999, the Department of Defense (DoD) and Department of Transportation (DoT) established a Tiger Team to streamline the Airframe & Powerplant (A&P) certification process for their aircraft maintenance technicians. Within DoT, FAA was the modal agency charged with developing the process. The eighteen-month endeavor of the FAA/DoD team yielded a successfully completed joint service cooperative project. In an effort to sustain the initiative's continuing viability and to ensure that future Federal Aviation Administration (FAA) decisions/policy changes affecting the A&P certification process, include military participation, the Joint Service Aviation Maintenance Technician Certification Council (JSAMTCC) has been established to work closely with the FAA. No changes to this program, its training and experience requirements, record-keeping and sign-off system, administrative procedures, or documentation can be changed without the approval of the Council.

JSAMTCC will be a functional advisory body to each respective United States military service's aviation maintenance organization and the FAA. The JSAMTCC reviews aircraft maintenance technician's training and experience from an FAA Airframe and Powerplant certification perspective, providing uniform assessments and recommendations to and for each military service and the FAA. All administrative and program procedural documentation will be under the control of this body. The data will be maintained by the Council and contained in a secure electronic data storage system that may be accessed by the FAA for review at any time.

The JSAMTCC shall meet at least annually and address issues pertaining to all aspects of an aircraft maintenance technician's training and experience. This will range from A&P specialty training courses, computer-based training, to formal documentation and policy. The complete charter, including current point of contact information for each branch, is attachment #1.

See Attachment #1 – Signature Document with Point's of Contact *Joint Service Aviation Maintenance Technician Certification Council (JSAMTCC) Charter*

## 1.7 AIRFRAME & POWERPLANT CERTIFICATION TESTING

Military personnel have encountered difficulties in the past being able to readily afford the cost of the current commercial computer-based knowledge testing and/or finding a location near their duty station where the tests are administered. One of the objectives of the development team was to address this issue and obtain the lowest possible cost and on-base testing for their personnel. The traditional military testing system of on-base testing for various educational accredited and for-credit programs is operated by the Defense Activity for Non-Traditional Education Services (DANTES). The logical method of accomplishing the testing objective was to develop a means by which DANTES could become qualified to administer the required FAA knowledge tests to the military in the same way that private testing organizations administer FAA knowledge testing for the civil community.

Meetings were held between the FAA, AFS 600 and AFS 340, the development team, and DANTES administrators. The DANTES group proved to the FAA that they have the ongoing ability to administer and proctor testing in a manner that is acceptable to the FAA and meets all of their testing administration standards. It was agreed that if the FAA could purchase, program, monitor, and maintain a test administration computer data server at the Oklahoma City FAA Center, it should be possible for DANTES to administer the A&P knowledge tests. It was also confirmed that it may be possible to bring the other FAA Certification/Rating tests on-line in the future. A Memorandum of Agreement was written, allowing both the FAA and DANTES, to formalize the relationship and parameters of conducting A&P testing for military personnel (see 1.7.1 below).

The military, through the various headquarter organizations at the Pentagon, is working on obtaining the approximately \$220,000 in funding necessary to purchase the required server and complete the programming necessary to bring the DANTES testing system on-line. Senior DoD staff agreed upon funding of the project, and the actual funding acquisition process is currently underway.

### 1.7.1 Memorandum of Agreement

A Memorandum of Agreement, approved and signed on May 19, 2000 by the FAA Regulatory Support Division, AFS 600 (Joseph Tintera), and DANTES (Dr. Barry Cobb) has been executed. Following is the text of this document:

This Memorandum of Agreement (MOA) between the Federal Aviation Administration (FAA), Regulatory Support Division, AFS-600, and the Defense Activity for Non-Traditional Education Services (DANTES) provides limited authority for DANTES to administer FAA airman knowledge tests to active-duty members of the Air Force (USAF), Navy (USN), Army (USA), Marine Corps (USMC), and Coast Guard (USCG).

A study was conducted by the military to determine why so few eligible military mechanics pursue the acquisition of an Airframe and Powerplant Mechanic (A&P) certificate. The responses led to three areas: (1) A&P certification is a cumbersome endeavor. (2) The cost of acquiring an A&P certificate is unaffordable to many service members. (3) There are many job opportunities in today's market that dissuade members from seeking employment in the civilian aviation industry.

A joint services enlistment incentive program, currently under development, has the goal of providing maintenance personnel with the opportunity to acquire the knowledge and skills required by the Federal Aviation Regulations to meet the eligibility requirements for an A&P certificate. The Department of Defense (DOD) and

Department of Transportation (DOT) have been working with the FAA's Continuous Airworthiness Maintenance Division, AFS-300, and Regulatory Support Division, AFS-600, to streamline the A&P certification process. To achieve this objective, the military services are developing a program that meets the Title 14, Code of Federal Regulations (CFR), Part 65 requirements for A&P mechanic certification. This is being accomplished in conjunction with recognition from the FAA of training provided to military aircraft mechanics, in addition to their military aircraft "hands-on" maintenance experience.

DoD will pursue funding for hardware purchase and software development, maintenance, and support. This essential funding will allow the FAA to deliver mechanic testing to DANTES test centers via the Internet, and provide the FAA with the means to achieve necessary data collection, data base management, and statistical analysis.

It is not the intention of the FAA to designate DANTES as a Computer Testing Designee (CTD). However, for purposes of clarity, the following titles listed in FAA Order 8080.6B, Conduct of Airman Knowledge Tests, will correspond to DANTES titles as follows:

Computer Testing Designee (CTD)	–	DANTES
Computer Testing Manager (CTM)	–	Manager, Certification Program (MCP)
Testing Center Supervisor (TCS)	–	Test Control Officer (TCO)
Test Proctor	–	Test Examiner

The FAA will maintain control of the test question banks, test forms, test delivery, and scoring. Computer testing stations in DANTES test centers will serve as delivery vehicles for testing of applicants, without the capability to gain access to the question banks, test forms, and score keys/question answers, except to the extent necessary for test delivery and administration.

However, DANTES will be responsible for the security of delivered tests during all phases of FAA testing, and for following test administration procedures in accordance with Order 8080.6B and the Airman Knowledge Testing Authorization Requirements Matrix for mechanic applicants. DANTES will be required to meet all other applicable requirements of Order 8080.6B, and subsequent revisions thereof, with the following exceptions:

Approved test centers will be required to maintain a minimum of one computer testing station. (In re: paragraph 1-9g.)

DANTES will not be required to maintain a minimum of 20 operational test centers, nor assure that its approved test center business hours are convenient to the public. FAA tests will be administered only to eligible, active-duty military, national guard, and reserve personnel. (In re: paragraph 2-3a.)

With respect to FAA tests, only the Aviation Mechanic – General (AMG), Airframe (AMA), and Powerplant (AMP) knowledge tests will be administered. Accuracy of the test banks will be maintained by the Airman Testing Standards Branch, AFS-630. (In re: paragraph 2-4b.)

DANTES will not be required to meet software development, maintenance, and support requirements. (In re: paragraphs 2-2 and 2-4.)

DANTES will not operate as a designee under 14 CFR Part 183. (In re: paragraph 2-6.)

AFS-630 will accept the usual and customary background investigations of DANTES test center personnel in place of Better Business Bureau or similar organization queries. (In re: paragraph 2-10.)



In order to maintain inspection and surveillance responsibilities, the FAA will be permitted unhindered access to all DANTES test centers that administer FAA tests.

When the requirements of this MOA and Order 8080.6B are met, and testing of applicants is determined by AFS-600 as ready to commence, AFS-600 will issue a Letter of Authorization (LOA) to the DANTES MCP. The LOA will permit DANTES to administer tests to eligible applicants at FAA approved test centers. A copy of the LOA will be kept at each approved test center and made available to FAA inspection personnel upon request. If a test center's copy of the LOA is lost or destroyed, a new copy must be obtained from the MCP prior to further FAA testing. The initial LOA and any subsequent LOA's will remain in effect for two years so long as this or subsequent MOA's remain in effect. In order to determine the need for continuance or revision, this MOA will be reviewed at least biennially beginning from the date of the first LOA.

### **1.7.2 Knowledge Testing**

Military personnel who successfully complete all required elements of this program will have met the eligibility requirements of Part 65.77. After presenting the *Certificate of Eligibility* to a FSDO, the FAA Aviation Safety Inspector (Airworthiness) will require the candidate to provide positive picture identification and complete two copies of the *Airman Certificate and/or Rating Application* form (FAA 8610-2) and sign them in the presence of the inspector. The military applicant will present the approved FAA Form 8610-2 to either an FAA authorized commercial testing center or DANTES testing site, where the FAA Part 65 knowledge test will be administered.

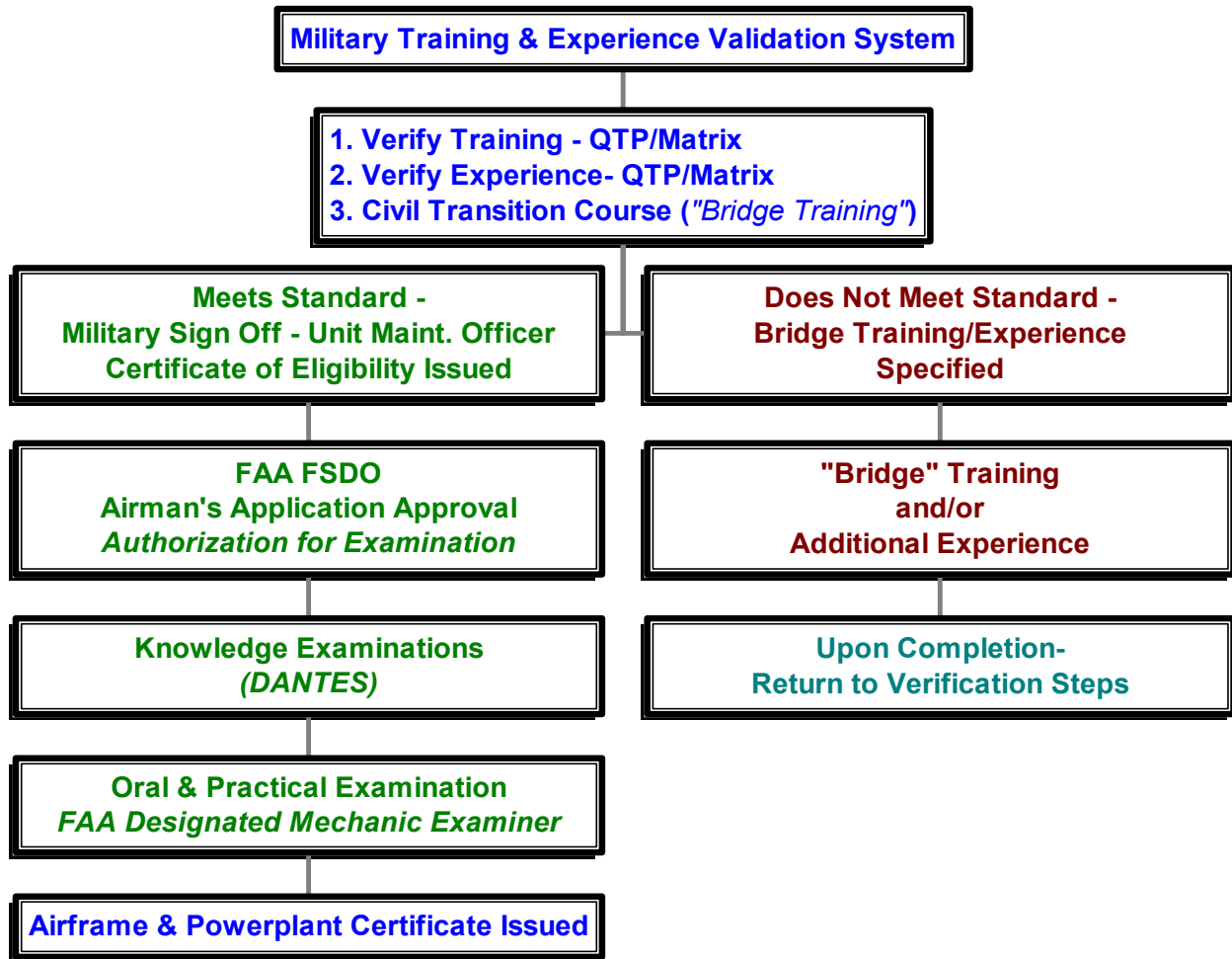
### **1.7.3 Oral and Practical Testing**

Oral and Practical testing for A&P certification will be accomplished through the current method of using FAA Designated Mechanic Examiners (DME) administering the oral and practical tests. The military, through the JSAMTCC, plans to work with the FAA in developing a means by which certain participating DMEs agree to conduct testing for military personnel who have completed this program at a standard "contracted" fee. The participating DMEs will be provided with information about the scope and content of this program so they will be prepared to examine program graduates under the appropriate guidelines.

## **1.8 NEW FAA/DOD A&P CERTIFICATION PROCESS**

The following chart depicts the basic steps that all military personnel will follow to obtain an FAA Airframe and Powerplant Mechanic Certificate. Though there will be internal administrative and procedural differences between branches, the outcomes have been structured to ensure that, from an FAA perspective, the process yields uniform results.

## ***A&P Certification Steps***



### **1.8.1 Procedural Steps to Obtain A&P Certification**

As shown in the *A&P Certification Steps* chart above, there is a pathway that each military AMT will follow to obtain the authorization to test and become certificated.

Following is a step-by-step definition and description of the program. Specific forms and documents discussed will be found in the appendix under the appropriate reference number.

#### **1.8.1.1 Program Enrollment**

Enrollment in this program by military personnel may be accomplished in various ways; over the internet, personal appearance at the appropriate DoD office/location (varies, depending upon service branch), or via telephone to the appropriate service branch's administrative element. There is no involvement on the part of the FAA until personnel who complete the program present themselves at an FAA FSDO with their *Certificate of Eligibility*, complete an *Airman Certificate and/or Rating Application*, and obtain authorization from the FSDO to test for certification.

### **1.8.1.2 Matrix and Customized CG-G-EAE-2 (10/99) FAA CERTIFICATION PERFORMANCE OF JOB TASKS Form Assignment**

Each joint service enrollee will be provided a customized CG-G-EAE-2 (10/99) form that will serve as both the individuals' QTP (Qualification Training Plan) and tasks sign off document. Form CG-G-EAE-2 is an official Government Printing Office (GPO) form that was originally developed by the Coast Guard and approved through the GPO process. The Coast Guard controls and maintains the masters of this form for each service branch. Although all services will use the form, any changes must be approved by the JSAMTCC prior to the Coast Guard making modifications.

The customization of the form is based upon on each individual's MOS, AFSC, or Rate. The matrix, based upon the CG-G-EAE-2, will guide the participant through the program based upon his/her individual military job classification's training program(s). The form also contains specific instructions for proper administration and sign off. The participant will use this form as both an individual program guide and for task sign off as they are completed. As mentioned in Executive Summary, tight control is maintained on this form and the process of its completion. Any falsification of this document is violation of the Federal Aviation Regulations and a criminal offense under the Uniform Code of Military Justice.

See Attachment #2 – A Typical *Qualification Training Package* (QTP) US Army version

See Attachment #3 – A Generic CG-G-EAE-2 (10/99) *FAA CERTIFICATION PERFORMANCE OF JOB TASKS* form

### **1.8.1.3 Completion of Required Training (“Bridge Training”)**

The Bridge Training requirements are based upon a Career Development Course (CDC). All CDCs assigned to an individual participant require competency testing as a part of the completion requirements. Course testing, as with all other military “off-duty” courses, will have proctored testing administered by DANTES or the appropriate learning/educational facility. Record of course completion is awarded with an individual course completion certificate and is recorded in the member's permanent service records.

The process has sound educational requirements, is well documented, validated by appropriate authorities and, as all training is completed, it is validated and properly recorded.

See Attachment #4 – Sample *Career Development Course* (CDC)

### **1.8.1.4 Validation of Program Completion – Certificate of Eligibility**

Once an individual participant completes all of the training and experience requirements called out on his/her individual *FAA Certification Performance of Job Tasks* (CG-G-EAE-2) form and it has been reviewed and signed by the appropriate branch's designated officer, a final review is conducted. Only after final review and validation of sign off will a *Certificate of Eligibility* be issued. The final review is accomplished by specific commands, depending upon the service branch. Validation of completed CG-G-EAE-2 forms is accomplished by an independent review of the participant's training and assignment records in their permanent personnel file. Air Force personnel are reviewed by the Community College of the Air Force at Maxwell Air Force Base in Alabama. The Army will conduct reviews through their Education and Training Services Branch offices, with oversight from the program's NCOIC (Non-Commissioned Officer in Charge) at the Non Commissioned Officer Training Command, Ft. Rucker, Alabama. The Navy and Marines have their review process at the headquarters of CNET (Command HQ, Naval Education and Training). The Coast Guard's review and validation process will be conducted through the A&P Program Manager of the Aviation Technical Training Center in Elizabeth City, North

Carolina. Only the review and validation organizations can issue an official program *Certificate of Eligibility*, properly signed and sealed.

The FAA has agreed, given acceptance and initiation of this program, that the FSDOs will accept the *Certificate of Eligibility* document as acceptable evidence of meeting the requirements of 65.77. The next step will be the signing of the *Airman Certificate and/or Rating Application* form by the authorized ASI at the applicant's FSDO.

See attachment #5 – Sample *Certificate of Eligibility*

#### **1.8.1.5 FSDO Approval - Completing *Airman Certificate and/or Rating Application* Form**

An individual who has completed the program must go to a FSDO in person to present the original (signed and sealed) *Certificate of Eligibility*. The *Airman Certificate and/or Rating Application*, form 8610-2(OMB Approval No. 2120-0022), may be pre-completed by the applicant and must accompany the *Certificate of Eligibility*. The applicant, after presenting positive picture identification, must sign both copies of the form in the presence of an Aviation Safety Inspector (Airworthiness).

During meetings with the FAA members of the development team, it was agreed that the following wording is acceptable on the application form in the following blocks:

EMPLOYER AND LOCATION – *Employer* is - Service Branch (U.S. - Air Force, Army, Coast Guard, Marines, Navy, and related National Guard or Reserves); *Location* is – Various

TYPE WORK PERFORMED: – “Completed the Joint Services Aviation Maintenance Technician Program: Airframe and Powerplant; or Airframe or Powerplant; See Completion Certificate (*Certificate of Eligibility*).”

#### **1.8.1.6 Testing of Applicant – DANTES or Commercial Testing Centers**

Once the *Airman Certificate and/or Rating Application* has been signed by an Aviation Safety Inspector, the applicant is authorized to take appropriate Knowledge Tests. All DANTES or commercial testing centers, once the program is up and running, can administer the tests as specified by FAA regulatory requirements. Successful passing of all the applicable parts of the examination will qualify the applicant to complete the final portion of certification, the Oral and Practical Examination.

#### **1.8.1.7 Oral and Practical Examination by a Designated Mechanic Examiner (DME)**

The JSAMTCC will establish a dialog with the interested members of the DME community and arrange a fixed fee structure for military personnel. Those DMEs participating will be listed by the JSAMTCC, and their names will be posted on the appropriate web sites. There is no FAA requirement for an applicant to engage a particular DME. The applicant may choose any authorized DME to administer the Oral/Practical exam. It would, however, be in the best interest of the applicant if they select a DME who is familiar both with this program and military aviation maintenance.

#### **1.8.1.8 FAA Certification as a Mechanic with Airframe and Powerplant Mechanic Privileges**

When the applicant has successfully completed the Oral and Practical Examination, the DME will issue a Temporary Airman's Certificate with the appropriate rating(s). The applicant, now certificate holder, may execute the privileges granted by the rating(s) held. The DME will handle all further documentation required by the FAA. The temporary certificate holder will receive a permanent certificate through the US Mail within 120 days.

## 1.8.2 Information Sharing – Keeping the “Troops” Up to Date

The internet and World Wide Web are being used extensively by the entire military complex. Aviation Maintenance is no exception. All branches have extensive web sites for their personnel containing vast amounts of information on all subjects relative to their duties, responsibilities, record systems, education and training, career development, and much more.

In this program, each service branch will have a web site that introduces and provides all the information needed for participation in the A&P Certification Program. All sites will be linked so that information can be shared. There will also be links to the FAA and other organizations that have information that participants may use to assist them in gaining certification. The sites will also be used to keep the participants up to date with program status, current civil aviation issues, and FAA certification, safety, and program information. The current web sites are:

**AIR FORCE:** <http://www.hill.af.mil/367trss/findex.htm> and <http://www.au.af.mil/au/ccaf>

**ARMY:** <http://www-rucker.army.mil/ap/AP.htm>

**COAST GUARD:** <http://www.uscg.mil/systems/attc/index.htm>

**NAVY/MARINES:** <http://namtg.cnet.navy.mil>

**FAA:** <http://www.FAA.gov>

**NTSB:** <http://www.NTSB.gov>

Once the FAA accepts the program, it will be announced and introduced on the military’s web sites. All branches have their web site designed and have inserted initial content... they are ready to launch.

## 1.9 SUMMARY OF FINDINGS

The United States Armed Forces have undergone significant changes in the recent years. This, for the most part, is due to downsizing, changes in technology, the peacekeeper role, and mission content. The old days of a specialty for most skills have long passed... affording this type of system is no longer possible nor is it feasible. While some specialization still exists, the amount of specialization has been dramatically reduced. Many non-military and infrastructure-related tasks (kitchen/mess duty, guard duty, and the like) formerly done by service personnel, have been taken over by civilians. Military aviation maintenance technicians are continually cross-utilized while in operational units and/or in the field. Other than maintaining the most sophisticated, state-of-the-art, weapons systems in the world, military aviation is more similar to civil aviation than it is different. Military and civilian maintenance training is almost identical. Only a few types of equipment and systems are not taught in the military, such as reciprocating engine and appliance technology, FAA rules and regulations, civil aircraft manuals and job documentation, plus a few other minor subject areas. The services have also become expert in the use of civilian “best business practices,” and use these techniques very effectively. Military training continually meets, and often exceeds, the requirements and standards of the civilian aviation industry.

The military services want this program to be accepted and become a reality. There are several drivers for this, including:

- Personnel recruitment
- Retention of maintenance staff
- Career development along with additional training
- The need to provide more A&P certificated AMTs to meet the growing shortage
- Meeting Department of Labor (DoL) post service job placement initiatives and apprenticeship standards
- Military pilots have a pathway to convert their experience and qualifications for FAA certification
- It is an incentive for increasing the professional standing of military AMTs
- The military personnel view the program as an added benefit for service
- All of the DoD and service branches support the program
- “It’s the right thing to do for our troops”

The development team agreed that most enlisted aviation maintenance personnel who have completed six years of military service and are at the rank of E-5 or higher, should be able to qualify for A&P certification testing under this program. It would be difficult, though possible, for most technicians with less than six years of military aviation maintenance experience to qualify, given the stringent requirements. (The Coast Guard is an exception. Since their training is a close parallel to Part 147 AMT schools, becoming eligible after the required 30 months minimum may be possible.)

The program was developed with processes that ensure that no FAA rule changes will be required. The content and operation of the DoD/FAA A&P Certification Program, after acceptance, will be deployed with revisions to FAA advisory and Aviation Safety Inspector Handbook materials. The existing Part 65 qualification and certification system will be used as the basis for formalizing the military A&P qualification process.

Some branches of the military currently have electronic service and training records. Those who have manual systems are in the process of transitioning to electronic systems. By the time this program is operational, with possible exception of the Coast Guard, all service branches should have electronic service and training records. This provides ease of documenting training and experience for military personnel; a means by which validation of training and experience can be accomplished by military authorities and be monitored and/or audited by the FAA.

This program has all of the elements necessary to fulfill the stated objective, and all of the requirements requested by the FAA team members have been met. The program has support from the highest military authorities and there will be a DoD oversight council that jointly administers and manages the program’s operation. The FAA can easily administer the program, conduct surveillance and monitor the individual applicant qualifications at any time. There is no additional cost to the FAA. The program should save Aviation Safety Inspectors a good deal of time in the qualifications review process, thus, creating savings for the FAA. The structure and approval process is easily audited and is stringent with consequences for violators under the FAA regulations and the Uniform Code of Military Justice.

FAA staff in Flight Standards Headquarters, Oklahoma City Operations and those in the Regional Offices and FSDOs who are involved and/or are aware of this program are strong supporters. The team worked directly with the FAA and accepted their guidance. Both the FAA and military have worked diligently in the development and preparation of this program. All service branches have worked together as a cohesive team, with complete cooperation between all members. This cooperation will hopefully lead toward ease in acceptance and rapid deployment of the program.

## 1.10 CONCLUSIONS

The military must remain a major source of maintenance personnel for the civilian industry. The shortage of qualified civil aviation maintenance personnel in the world today serves to validate this factor. The conversion of military personnel to FAA A&P certification will be a straightforward, controlled process once this program is in place. All those who know of this effort and what is being accomplished, both approve and support the effort.

It is considered to be a win-win program, benefiting both military and civil aviation. The military services benefit, as there will be a formal program that provides a pathway for their aviation maintenance personnel to document their training and experience to become A&P certificated. There is a significant shortfall in persons joining the military and this program provides the services with a new recruiting incentive and personnel-retention opportunity. At the same time, there is a worldwide shortage of AMTs which is becoming severe. Industry benefits as there will be more experienced and well-qualified people with A&P certification coming from the military to help reduce this shortage.

The program has a very low cost impact. The military will invest in a few people to monitor the program, develop, provide and maintain the so-called “bridge training” courses, and keep the program current. The FAA will be able to maintain, conduct surveillance and audit the program with no additional staff and no rule changes.

Given the experience requirements and additional training called out in each participants Qualification Training Plan, military A&P certification candidates meet, and generally exceed, FAA qualification requirements under Part 65.77. There can be no question that this program meets all of the guidelines and requirements of the DoD, DoL, and, most importantly, the FAA.

## 1.11 RECOMMENDATIONS

1. FAA personnel have participated in the development of this program. They have asked for specific practices and procedures. All of the requirements set forth by the FAA participants have been met. FAA management should evaluate and accept the FAA/DoD A&P Certification program as quickly as possible.
2. After acceptance, a small FAA team consisting of staff from AFS 300 (340) and AFS 600, should convene to prepare the required documentation. It has been suggested that the documentation required consist of an Aviation Safety Inspector’s Handbook Bulletin, describing the features, major elements, documents, and operation of this program. In addition, appropriate changes to the Aviation Safety Inspector’s Handbook (FAA Order 8300.10) and Aviation Mechanic Examiner’s Handbook (8610.4) will be required to reflect the content, implementation, and inspector activities relative to military applicants who have completed this program.
3. The FAA should publicize the acceptance and adoption of this program. This will show support for our military services and recognize the significant long-term contribution of military aviation maintenance to the civil industry. It will also serve as notice to the military commanders and DoD officials that the FAA recognizes and supports their efforts toward improving professionalism and safety in the maintenance arena.
4. Recognition should be given to the foresight of those in AFS 300 that promoted and supported this important effort. This entire task, given the high level of support and cooperation from DoD and the



military, would not have come to a successful conclusion without the cooperation and support of these individuals.

5. The FAA Office of Aviation Medicine should also be commended for their support of the research required to allow this program to go forward. Had they not provided contractor support through the guidance of AFS 340, the military alone could not have completed the task.
6. All of these recommendations should be implemented as quickly as possible. Especially those affecting the acceptance and the launching of this program. Quickly approving and moving the program forward will show commitment, sense of urgency, and a high level of support from the FAA.

## **ACKNOWLEDGEMENTS**

The development of this program was accomplished through the diligent effort, cooperation, and hard work of the Development Team. The level of effort and cooperation between the military service branches and the level of support from the FAA were both outstanding. This report would not be complete without listing the names of those that participated and ensured that the FAA/DoD A&P Certification Program was a complete success. The team members, in alphabetical order, are:

**Baird, Eric, ASI – FAA**

**Breeding, J. R., MSgt – USAF**

**Bridges, J.K. “Sid”, AVCM – USN**

**Browning, Mathew, LCDR – USN**

**Castellano, Dave, GySgt – USMC**

**Chamberlin, Dave, SSgt – USAFANG, ATA Airlines**

**Desso, Henry, Mgr. – Delta Airlines**

**Elbert, Denise, SSgt - USAF**

**Embry, Glenn, Supv. – 367 TRSS (USAF)**

**Foster, Paul M., Jr., ASI – FAA**

**Funk, Larry, CMSgt – USAF**

**Gindlesperger, Bruce, Mgr. – Delta Airlines**

**Hamilton, Thomas, SFC – USA**

**Hawk, Bruce L., CAPT - USN**

**Iannone, Edward, CSM – USA**

**Martin, Gary, ASI – FAA**

**Mayle, Jeff, SMSgt – USAF**

**Montgomery, Randolph, ASI – FAA**

**Nelson, Rhuno J., Mgr. – FAA**

**Oxner, Mark, CMSgt – USAF**

**Pickelsimer, Bill – Mgr. – FAA**

**Riske, Frank, MSgt – USAF**

**Santos, Dan, CMSgt – USAF**

**Sheehan, Brian, SFC – USA**

**St. Aubin, Don, MCPO – USCG**

**Sullivan, James, MSgt – USAF**

**Vipond, Les , ASI – FAA**

**Winborne, Sandra, Mgr. - DANTES**

**Watson, Jean, PC - FAA**

## **1.13 ATTACHMENTS**

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## ***Attachment #1 – JSAMTCC Charter***

### ***Joint Service***

### ***Aviation Maintenance Technician Certification Council (JSAMTCC)***

#### ***Charter***

(October - 2000)



1. During 1998, the Department of Defense (DoD) and Department of Transportation (DoT) established a Tiger Team to streamline the Airframe & Powerplant (A&P) certification process for their aircraft maintenance technicians. The two-year endeavor yielded a successfully completed joint service cooperative project. In an effort to sustain the initiative's continuing viability and to ensure that future Federal Aviation Administration (FAA) decisions/policy changes, affecting the A&P certification process, include military participation/involvement, the Joint Service Aviation Maintenance Technician Certification Council (JSAMTCC) is being established to work closely with the FAA.
2. JSAMTCC is a functional advisory body to each respective United States Military Service's Aviation Maintenance Division and the Federal Aviation Administration (FAA). The JSAMTCC reviews aircraft maintenance technician's training and experience from a FAA Airframe and Powerplant (A&P) certification perspective, providing a united assessment and recommendations to/for each military service and the FAA.
3. The JSAMTCC meets annually and addresses issues pertaining to all aspects of an aircraft maintenance technician's training and experience ranging from A&P specialty training courses, computer based training to formal documentation and policy.
4. Any military aviation technician may submit issues for the JSAMTCC to review. Issues submitted for review may be submitted through JSAMTCC members, the JSAMTCC chairperson, or Military Service Point of Contact (MSPOC). MSPOCs will contact their JSAMTCC member(s) to submit issues for discussion. JSAMTCC members/chairperson will determine whether or not submitted issues warrant the JSAMTCC's attention. Issues must address aviation maintenance technician's training and experience from a FAA A&P certification perspective. The JSAMTCC discusses and (if applicable) submits their recommendations to the appropriate military service or FAA policy decision level for appropriate action.
5. The JSAMTCC is composed of one voting member from each participating military branch of service (Air Force, Army, Navy, Marines and the Coast Guard for a total of five voting members), two FAA advisors from AFS 300 and AFS 600, and technical advisors from various disciplines. The chairperson and facilitator are part of the voting membership. Members represent the entire military aircraft maintenance training and education community on matters concerning the FAA certification of military aviation technicians. An Air Force Career Field Manager (AFCFM) assigned to HQ USAF/ILMM functions as the JSAMTCC Chairperson.

5.1. Each military branch of service will alternate hosting the annual JSAMTCC working group. Participants are responsible for budgeting/funding to attend. The JSAMTCC chairperson will appoint hosting service on a rotation basis. The hosting units JSAMTCC member assumes the responsibility of JSAMTCC Facilitator.

5.2. The FAA advisors, AFS 300 and AFS 600, serve as FAA certification and policy advisors, respectively.

5.3. Meeting attendance by JSAMTCC members is mandatory to participate in voting.

6. JSAMTCC members serve as part of the council during their tenure in the duty position identified herein. Individuals permanently reassigned to duties not related to aircraft maintenance will be replaced.

6.1. The following list reflects the JSAMTCC member appointing authority for each military branch:

**Air Force**

HQ USAF/ILM  
1030 Air Force Pentagon  
Washington, D.C. 20330-1030

**Army**

HQ US Army  
Aviation Center/Commander  
Fort Rucker, AL 36362-5000

**Navy**

Head Aviation Manpower and Training, N889  
2000 Navy Pentagon  
Washington D.C. 20350-2000

**Marines**

Training and Education Command MCCDC  
3300 Russell Road  
Quantico, VA 22134-5001

**Coast Guard**

Commandant (G-WT)  
2100 Second Street, S.W.  
Washington, D.C. 20593-0001

6.2. The following list identifies the appointed duty positions from each respective military service to function as JSAMTCC members:

**Air Force (Chairperson)**

HQ USAF/ILMM  
Air Force Career Field Manager  
1030 Air Force Pentagon  
Washington, D.C. 20330-1030

**Army**

HQ US Army Aviation Center  
Commandant  
Noncommissioned Officers Academy  
Fort Rucker, AL 36362-5000

**Navy**

Aviation Technical Training Section, N889H  
2000 Navy Pentagon  
Washington D.C. 20350-2000

**Marines**

Aviation Training Branch C473 MCCDC  
3300 Russell Road  
Quantico, VA 22134-5001

**Coast Guard**

USCG AVTECHTRACEN  
AMT Rating Manager  
Elizabeth City, NC 27909

7. Military aircraft maintenance branches will identify the aircraft maintenance related duty positions to serve on the JSAMTCC. These individuals should possess a broad aviation technical background and be at a level to affect change within aviation maintenance training (possession of an A&P certificate desirable).

8. JSAMTCC voting members (does not include advisors) consist of one individual from each of the five participating military branches and are charged with performing in one of the following capacities.

8.1. **Chairperson**

8.1.1. Perform as the focal point for all coordination and communications between military branches and the FAA concerning A&P certification matters.

8.1.2. Plan, coordinate, and lead all sessions of the JSAMTCC, guiding discussion and ensuring focus on agenda topics and resulting actions. Ensure meeting minutes and action items are documented and signed by members before the JSAMTCC is adjourned.

8.1.3. Act as focal point for submitted and proposed agenda topics; develop and distribute a prioritized/proposed agenda to JSAMTCC members NLT four weeks prior to a scheduled JSAMTCC meeting.

8.1.4. Assign action items to appropriate OPR/OCR members and manage follow-up suspenses.

8.1.5. Serve as OPR for membership selections and custodian of the JSAMTCC Charter.

8.2. **Member**

8.2.1. Attend all scheduled meetings.

8.2.2. Ensure appropriate staffing on assigned or coordinated action items is completed by suspense date and IAW standard guidance, suitable for general/flag officer review.

8.2.3. Meet suspense's for assigned projects or request extensions through the chairperson and provide interim response and/or status update with new milestones.

8.2.4. Actively represent the JSAMTCC in their military service and brief its purpose and contributions.

8.2.5. Solicit topics from their branches and functional community prior to upcoming JSAMTCC meetings.

8.3. **Facilitator**

8.3.1. The host of the JSAMTCC will assume the position of the facilitator.

8.3.2. Guide JSAMTCC discussion to keep issues in focus and to ensure courses of action are established to address these issues.

8.3.3. Serve as the chairperson if the designated chairperson becomes unavailable.

8.3.4. Document meeting minutes (including action items) during the JSAMTCC. Ensure minutes are approved by members and distributed within thirty days of the meeting.

8.3.5. Perform functions as required by the chairperson.

9. Questions concerning this charter can be directed to the Air Force Career Field Manager in HQ USAF/ILMM, DSN 223-4490, COMM 703-693-4490.

**Signatures:**

**ANTHONY R. JONES**

Major General, U.S. Army

Commanding General

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**A.M. GEMMILL**

Rear Admiral, U.S. Navy

Head, Aviation Manpower and Training

---

**THOMAS S. JONES**

Brigadier General, U.S. Marine Corps

Commanding General, Training & Education Command

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***R. D. SIROIS***

Rear Admiral, U.S. Coast Guard

Director of Reserve and Training

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**TERRY L. GABRESKI**

Brigadier General, U.S. Air Force

Director of Maintenance, DCS/IL

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## ***Attachment #2 – Qualification Training Plan – Typical (US Army Version)***

### **Airframe and Powerplant Certification Instruction Packet – U.S. Army**

## **Introduction**

As the Armed Forces decrease in size and become more expeditionary, the need for multi-skilled aviation mechanics will increase. In the past, our large military forces required a high degree of specialization. Specialization allowed the military services to conduct their mission and training in the most efficient way for the demands placed upon them. Today, this situation has changed. The decrease in overseas presence and increased deployment demand has driven a greater need for aviation mechanics with more skills. Experienced mechanics that have higher levels of training in all facets of aircraft maintenance are more valuable to the services in meeting the increased deployment demand with leaner logistics requirements. The skills sought for experienced mechanics parallel favorably with the Federal Aviation Administration (FAA) Airframe and Powerplant (A&P) Certification requirements. The intent of this QTP is to outline a voluntary FAA A&P certification program that benefits both the individual and the armed forces. Another key goal of this package is to educate personnel on the FAA A&P certification process. This package is available to military members and civilian employees of the US Army, US Navy, US Marine Corps, US Coast Guard, and US Air Force.

## **General**

- a. This QTP standardizes the military airframe and powerplant certification program and constitutes an approved military program that the Armed Forces and the FAA use for A&P certification. This is used by US Army, US Navy, US Marine Corps, US Coast Guard, and US Air Force military aircraft maintenance personnel, supervisors, trainers, trainees, training managers, and other training functions to plan, conduct, and document military aviation training for Airframe, Powerplant, or Airframe & Powerplant certification. The Air Force is the lead agency for providing this training package for all military services. Members of other services will follow service unique instructions included in this package.
- b. This package outlines the method for the “Military Program” but there are also two other methods for obtaining FAA A&P certification. First, military members can pursue A&P certification through Part 65, which requires 18 months of documented experience of Airframe, 18 months of documented experience of Powerplant or 30 months of documented experience for both. Second, Part 147 (A&P schools) can be used which requires 1150 hours of class room instruction for Airframe, 1150 hours of class room instruction for Powerplant or 1900 hours of classroom instruction of both Airframe and Powerplant. This QTP provides step-by-step instructions for obtaining A&P certification through military training programs. This route to A&P certification is rigorous and prepares members well for meeting the demands of repairing sophisticated, computer controlled aircraft and systems. Personnel use this QTP in an individual voluntary training program (assisted by military formal training and on-the-job training) to obtain A&P certification.

## Military Program

a. This military program only applies to personnel that have graduated from a 67 or 68 series MOS and received 18 months of Airframe experience, 18 months of Powerplant experience or 30 months of both Airframe and Powerplant.

b. Use of the FAA certified MOS Matrix form is mandatory. This will be provided by your Education Center.

### I. Services Instructions (Army)

a. Applicability: All soldiers that have graduated from a 67 or 68 series MOS Advanced Individual Training (AIT). The automated FAA certified, MOS Matrix form is only applicable to 67 or 68 series MOS's.

b. Aircraft Maintenance Office Certifications: Aircraft Maintenance Officer must be WO-1 or above and assigned, on orders, as the Production Control Officer. The Aircraft Maintenance Officer is certifying that all individual eligibility requirements above are met. The Aircraft Maintenance Officer verifies the number of months the individual has been in aircraft maintenance field and inserts this information when certifying the form.

(1) Aircraft Maintenance Officer must ensure the individual uses the FAA certified MOS Matrix form applicable to the member's MOS.

(2) Aircraft Maintenance Officer is required to review member's training records.

c. Certifiers: Certifiers must be SGT/E-5, 67/68 CMF BNCOC Graduate or above or an A&P certified person. Only qualified certifiers can certify that the member has successfully met the training item to the specified FAA training level. It is **not** necessary for the certifier to **actually** provide the training. Training may be provided by anyone qualified on the task. Always use an A&P certified person as a certifier if possible. There are no grade requirements for A&P certified personnel. Certifiers who possess an A&P are required to enter their A&P certification number on the form. Certifiers who **are not** A&P certified are required to enter rank and pay grade on the form. Certifiers initial in the OJT column and enter the completion date when the required training has been completed.

d. FAA Certification on the Form: Certifiers must note that FAA certification **is not the same as Army certification**. Army certification is task completion certification—FAA certification is associated with the FAA levels explained on the front page of your Matrix. FAA level 3 is similar to Army task certification.

e. Training Records: Always keep an updated copy of your training qualifications. Keep copies of all, training certificates, and other records of training. These records can be used to assist the FAA Flight Standards Office in determining your qualifications. Use automated records if possible. Automated training records are viewed as better records of your training and qualifications than hand-scribed training records. Use of the FAA certified MOS Matrix is mandatory to participate in this program.

f. Instructions: Obtain the FAA certified MOS Matrix form from your Education Center. Items annotated with an (\*) are mandatory and **must** be completed. Follow the line-by-line instructions below to obtain additional training. If the task listed on your MOS Matrix is already checked off

you do not need to complete that task according to the following instructions. A key component of your FAA certification is recognizing that technical orders/manuals/instructions are to be used and your ability to use them

**Note:** The Airframe and Powerplant Career Development Course (CDC) and all other Computer Based Training (CBT) may be completed at any time. Members are cautioned to always keep all course completion records. **NEVER** throw away **ANY** documentation on completed training.

g. Recommended training steps:

*Step 1:* Complete Airframe and Powerplant CDC, Delta Airlines CBT, Federal Aviation Regulations CBT and weighing aircraft CBT.

*Step 2:* Complete training on launching, recovering, servicing, and performing preflight and post flight inspections. You must perform and be task certified on these task items: launch, recovery, marshal, service, preflight, and post flight. You must be able to remove, replace, and inspect wheels and brakes. Annotate task training on the FAA certification sheet

*Step 3:* Complete training on connector repairs, pitot-static leak checks, and other avionics training requirements. You must perform and be task certified on the items indicated in line instructions such as pitot-static leak checks and soldering a connector. You must be exposed to engine instruments troubleshooting, flight instruments, operational checks on flight controls and inertial systems. It is recommended that completion of high volume core tasks such as operational checks and component replacement on radios be completed. You must participate in a variety of avionics repair actions. Annotate task training on the FAA certification sheet.

*Step 4:* Complete training on connector repairs, electrical systems repairs, and environmental systems. You must perform and be task certified on the items indicated in line instructions such as multimeter use, servicing batteries, troubleshooting and repairing aircraft lighting systems, removal and replacement of circuit breakers, wiring, switches, and soldering. They must be exposed to engine fire warning and electrical systems, ignition systems, and oxygen systems. It is recommended that completion of high volume core tasks such as removal and replacement of lox converters, repairing lights, and batteries be completed. You must participate in a variety of electrical-environmental repair actions. Annotate task training on the FAA certification sheet

*Step 5:* Complete training on structures repairs and finishes. You must perform and be task certified on a simple repair involving forming, layout, and bending sheet metal and use of conventional rivets. Training may be conducted on scrap metal. You must be certified on inspecting structures; and using calipers and micrometers. You must be exposed to bonded surfaces, honeycomb, composites, and laminated primary and secondary structures. It is recommended that completion of high volume core tasks be completed. You must participate in a variety of structural repair actions. Annotate task training on the FAA certification sheet

*Step 6:* Complete training on a major phase inspection. You must perform inspections in other areas such as engines, flight controls, landing gears, and structures. You must participate in all facets of the phase inspection as indicated in the line instructions below. You must participate as a member of a work crew jacking an aircraft; and removing and replacing a primary/secondary control surface. You must be able to use a protractor, tensiometer, and inclinometer. You must be certified on inspecting structures and identifying defective welds. You must be exposed to bonded surfaces, honeycomb, composites, and laminated primary and secondary structures. You must participate in a variety of phase inspection and repair actions. Annotate task training on the FAA certification sheet

*Step 7:* Complete training on an engine overhaul. It is recommended that personnel assist in at least one major engine build-up as a member of a engine build-up crew. Member must work with Engine personnel ***exclusively***. You must participate in all facets of the engine inspection and repairs as indicated in the line instructions below. You must participate in a variety of engine inspection and repair actions. You must be able to do an engine tailpipe inspection, remove and replace major components such as fuel controls, fuel shutoff valves, operational check a fire loop and fire extinguishing squibs. Annotate task training on the FAA certification sheet

*Step 8:* Complete engine run training. Member ***is not*** required to actually run the engine; but must complete all training up to that point. Annotate task training on the FAA certification sheet.

*Step 9:* Take completed and signed Matrix back to Education center to obtain Certificate of Eligibility and 3 (three) separate FAA form 8610-2 (Airman Certificate and/or Rating Application). 1 (one) for the General written test, 1 (one) for the Airframe written test and 1 (one) for the Powerplant written test. You must also have 3 copies of each, 1 (one) for the Flight Safety District Office (FSDO), 1 (one) for the FAA and 1 (one) for you.

*Step 10:* Take Certificate of Eligibility and your copies of FAA form 8610-2 to your local FSDO and get them signed.

*Step 11:* Return to the Education center and complete the general, airframe, and powerplant tests. Your score will be given to you immediately.

*Step 12:* Complete Oral and Practical (O&P) exams ***within two years of completing the written test*** by finding your local Designated Maintenance Examiner (DME). Your Education Center Counselor should have information on where the nearest one is. You will be expected to answer a variety of questions and to perform a variety of tasks to ensure you have the required knowledge and can competently complete selected tasks. It is up to the discretion of the DME to select the tasks.

*Step 13:* The DME will issue you a temporary license and submit your completion paperwork to the FAA for you're permanent A&P certification and license number.

## **7. Line Instructions.**

**NOTE:** If the task listed on your MOS Matrix is already checked off you do not need to complete that task according to the following instructions.

# **GENERAL CURRICULUM SUBJECTS**

## **A. Basic Electricity.**

- Task A1. Complete Airframe and Powerplant Development and Delta Airlines CBT.
- Task A2. Complete Airframe and Powerplant Development and Delta Airlines CBT.
- Task A3. Complete task certification on use of multimeter making these measurements via OJT. Unit electricians or avionics personnel can provide training.

- Task A4. Complete Airframe and Powerplant Development and Delta Airlines CBT.
- Task A5. Complete Airframe and Powerplant Development and Delta Airlines CBT.
- Task A6. Complete task certification on servicing batteries from battery shop.

#### **B. Aircraft Drawings.**

- Task B7. Complete Airframe and Powerplant Development and Delta Airlines CBT.
- Task B8. Complete training on a structural repair via OJT. Obtain training from the Sheet Metal Shop.
- Task B9. Complete training on a structural repair via OJT. Obtain training from the Sheet Metal Shop.
- Task B10. Complete training on a structural repair via OJT. Obtain training from the Sheet Metal Shop.

#### **C. Weight and Balance.**

- Task C11. Complete CBT on weighing aircraft.
- Task C12. Perform an aircraft weight and balance. Must be able to fill out and calculate forms.

#### **D. Fluid Lines and Fittings.**

- Task D13. Complete training via OJT. Obtain training from the Sheet Metal Shop (rigid lines) and/or hydraulic shop (flexible lines).

#### **E. Materials and Processes.**

- Task E14. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task E15. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task E16. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task E17. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task E18. Complete training via OJT. Member is required to assist on either a jet engine build-up crew or on an aircraft major phase inspection.
- Task E19. Complete training via OJT. Member must be certified on using micrometers, calipers, and other precision devices.

#### **F. Ground Operation and Servicing.**

- Task F20. Member is **NOT** required to actually run an engine; but must complete ALL training up to that point.

- Task F21. Complete Airframe and Powerplant Development course and Delta Airlines CBT.

#### **G. Cleaning and Corrosion Control.**

- Task G22. Complete training via OJT. Participate in a major phase inspection.
- Task G23. Complete training via OJT. Participate in a phase inspection and obtain training in treating corrosion..

#### **H. Mathematics.**

- Task H24. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task H25. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task H26. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task H27. Complete Airframe and Powerplant Development course and Delta Airlines CBT.

#### **I. Maintenance Forms and Records.**

- Task I28. Complete CBT on civilian maintenance records. Must know what form 337 is and how to fill it and civilian log books out.
- Task I29. Complete CBT on civilian maintenance records.

#### **J. Basic Physics.**

- Task J30. Complete Airframe and Powerplant Development course and Delta Airlines CBT.

#### **K. Maintenance Publications.**

- Task K31. Complete CBT on civilian maintenance forms, publications, and FAA Rules and Regulations. Must know ATA 100 specifications.
- Task K32. All Army 67/68 CMF personnel have completed this requirement.

#### **L. Mechanic Privileges and Limitations.**

- Task L33. Complete CBT on Federal Aviation Regulations.

## **AIRFRAME CURRICULUM SUBJECTS**

### **I. AIRFRAME STRUCTURES.**

#### **A. Wood Structures.**

- Task A1. Complete Airframe and Powerplant Development course and Delta Airlines CBT.

- Task A2. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task A3. Complete Airframe and Powerplant Development course and Delta Airlines CBT.

#### **B. Aircraft Covering.**

- Task B4. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task B5. Complete Airframe and Powerplant Development course and Delta Airlines CBT.

#### **C. Aircraft Finishes.**

- Task C6. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task C7. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task C8. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task C9. Complete training via OJT. Member is required to assist on an aircraft major phase inspection.

#### **D. Sheet Metal and Non-Metallic Structures.**

- Task D10. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task D11. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task D12. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task D13. Complete training via OJT. Member is required to assist on an aircraft major phase inspection.
- Task D14. Complete training via OJT. Obtain training from the Sheet Metal Shop. Must perform a simple repair. Performance may be on scrap metal and materials.
- Task D15. Complete training via OJT. Obtain training from the Sheet Metal Shop. Must perform a simple repair, and calculate setback, radius, etc. Performance may be on scrap metal and materials..
- Task D16. Complete training via OJT. Obtain training from the Sheet Metal Shop. Must perform a simple repair. Performance may be on scrap metal and materials.

#### **E. Welding.**

- Task E17. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task E18. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task E19. Complete Airframe and Powerplant Development course and Delta Airlines CBT.

- Task E20. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Must perform a simple soldering task such as soldering wires on a connector or repairing a communications cable. Complete this training via OJT. Obtain training from Avionics personnel.
- Task E21. Complete Airframe and Powerplant Development course and Delta Airlines CBT.

#### **F. Assembly and Rigging.**

- Task F22. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task F23. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task F24. Complete training via OJT. Member is required to assist on an aircraft major phase inspection.
- Task F25. Complete training via OJT. Member is required to assist on an aircraft major phase inspection. Member must work as part of a team removing and replacing a primary/secondary flight control surface.
- Task F26. Complete training via OJT. Member is required to assist on an aircraft major phase inspection.
- Task F27. Complete training via OJT. Member is required to assist on an aircraft jack.

#### **G. Airframe Inspection.**

- Task G28. Complete training via OJT. Member is required to assist on an aircraft preflight, post flight, and major phase inspection.

### **II. AIRFRAME SYSTEMS AND COMPONENTS.**

#### **A. Aircraft Landing Gear Systems.**

- Task A29. Complete training via OJT. Member is required to assist on an aircraft major phase inspection.

#### **B. Hydraulic and Pneumatic Power Systems.**

- Task B30. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task B31. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task B32. Complete training via OJT. Member is required to assist on an aircraft major phase inspection. Member is also required to perform a basic preflight/post flight inspection.

#### **C. Cabin Atmosphere Control Systems.**

- Task C33. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task C34. Complete Airframe and Powerplant Development course and Delta Airlines CBT.



- Task C35. Complete training via OJT. Member is required to perform a basic preflight/post flight inspection.

#### **D. Aircraft Instrument Systems.**

- Task D36. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task D37. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Complete training via OJT. Member is required to perform a pitot-static leak test. Obtain training from Avionics Shops.

#### **E. Communication and Navigation Systems.**

- Task E38. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task E39. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task E40. Complete training via OJT. Member is required to assist on an aircraft major phase inspection.

#### **F. Aircraft Fuel Systems.**

- Task F41. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task F42. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task F43. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task F44. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Complete training via OJT. Member is required to assist on an aircraft major phase inspection; and remove and replace fuel lines, external/internal fuel tanks, and fuel probes.
- Task F45. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Complete training via OJT. Member is required to work as a team member on an aircraft major phase inspection.
- Task F46. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Complete training via OJT. Member is required to assist on an aircraft major phase inspection.
- Task F47. Complete training via OJT. Member is required to assist on an aircraft major phase inspection.

#### **G. Aircraft Electrical Systems.**

- Task G48. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Complete training via OJT. Hands-on training on crimping and splicing wires, and repairing pins and sockets can be obtained from avionics shops.
- Task G49. Complete training via OJT. Hands-on training can be obtained from avionics or electrical shops.

- Task G50a. Complete training via OJT. Hands-on training can be obtained from avionics or electrical shops. Member is also required to assist on an aircraft major phase inspection.
- Task G50b. Complete Airframe and Powerplant Development course and Delta Airlines CBT.

#### **H. Position and Warning Systems.**

- Task H51. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Member is also required to assist on an aircraft major phase inspection or as a team member on flight line troubleshooting/repair actions.
- Task H52. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Member is also required to assist on an aircraft major phase inspection or as a team member on flight line troubleshooting/repair actions.

#### **I. Ice and Rain Control Systems.**

- Task I53. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Member is also required to assist on an aircraft major phase inspection.

#### **J. Fire Protection Systems.**

- Task J54. Complete Airframe and Powerplant Development course and Delta Airlines CBT.
- Task J55. Complete Airframe and Powerplant Development course and Delta Airlines CBT. Member is also required to assist on an aircraft major phase inspection or as a team member on flight line troubleshooting/repair actions.

## **POWERPLANT CURRICULUM SUBJECTS**

### **I. POWERPLANT THEORY AND MAINTENANCE.**

#### **A. Reciprocating Engines.**

- Task A1. Complete Airframe and Powerplant Development course and Delta CBT.
- Task A2. Complete Airframe and Powerplant Development course and Delta CBT. Hands-on requirements are waived.
- Task A3. Complete Airframe and Powerplant Development course and Delta CBT. Hands-on requirements are waived.
- Task A4. Complete Airframe and Powerplant Development course and Delta CBT. Hands-on requirements are waived.

#### **B. Turbine Engines**

- Task B5. Complete Airframe and Powerplant Development course. Member is required to assist on an engine overhaul in the jet engine intermediate maintenance shop or complete an engine intermediate maintenance training course.
- Task B6. Complete Airframe and Powerplant Development course. Member is required to assist on an engine overhaul in the jet engine intermediate maintenance shop and assist on an aircraft major phase inspection.
- Task B7. Complete Airframe and Powerplant Development course. Member is required to assist on a full engine removal and replacement action on the aircraft. Member must be aware of all safety and repair procedures.

### **C. Engine Inspection.**

- Task C8. Complete Airframe and Powerplant Development course. Complete Delta CBT. Complete training via OJT. Member must be able to review technical manuals and engine maintenance records to validate engine removal and replacement actions. Member must also be able to determine if the proper equipment is installed on the engine/aircraft.

## **II. POWERPLANT SYSTEMS AND COMPONENTS.**

### **A. Engine Instrument Systems.**

- Task A9. Complete Airframe and Powerplant Development course. Complete training via OJT. Training can be obtained from avionics shops.
- Task A10. Complete Airframe and Powerplant Development course. Complete training via OJT. Training can be obtained from avionics shops. Member is required to assist on an aircraft major phase inspection.

### **B. Engine Fire Protection Systems.**

- Task B11. Complete Airframe and Powerplant Development course. Complete training via OJT. Member is required to assist on an aircraft major phase inspection.

### **C. Engine Electrical Systems.**

- Task C12. Complete Airframe and Powerplant Development course. Complete training via OJT. Training can be obtained from electrical-environmental.
- Task C13. Complete Airframe and Powerplant Development course. Complete training via OJT. Training can be obtained from avionics shops.

### **D. Engine Lubricating Systems.**

- Task D14. Complete Airframe and Powerplant Development course. Complete training via OJT. Training can be obtained from crew chiefs. Certification on launching, recovering, marshalling, servicing, preflight, and basic postflight is required.

- Task D15. Complete Airframe and Powerplant Development course. Member is required to assist on an engine overhaul in the engine shop or complete an engine intermediate maintenance-training course.
- Task D16. Complete Airframe and Powerplant Development course. Member is required to assist on an engine overhaul in the engine shop or complete an engine intermediate maintenance-training course.

#### **E. Ignition and Starting Systems.**

- Task E17. Complete Airframe and Powerplant Development course. Complete Delta CBT.
- Task E18. Complete Airframe and Powerplant Development course. Complete Delta CBT. Complete training via OJT. Member is required to assist on an engine overhaul in the engine shop or complete an engine intermediate maintenance-training course.
- Task E19a. Complete Airframe and Powerplant Development course. Member is required to assist on an engine overhaul in the engine shop or complete an engine intermediate maintenance-training course.
- Task E19b. Complete Airframe and Powerplant Development course.

#### **F. Fuel Metering Systems.**

- Task F20. Complete Airframe and Powerplant Development course.
- Task F21. Complete Airframe and Powerplant Development course.
- Task F22. Complete Airframe and Powerplant Development course. Complete training via OJT. Repair actions such as removal/replacement of digital electronic engine controls, valves, etc. will meet this requirement.
- Task F23. Complete Airframe and Powerplant Development course. Complete Delta CBT. Member is required to assist on an engine overhaul in the engine shop or complete an engine intermediate maintenance-training course.

#### **G. Engine Fuel Systems.**

- Task G24. Complete Airframe and Powerplant Development course. Member is required to assist on an engine overhaul in the engine shop or complete an engine intermediate maintenance-training course.
- Task G25. Complete Airframe and Powerplant Development course. Member is required to assist on an engine overhaul in the engine shop or complete an engine intermediate maintenance-training course.

#### **H. Induction and Airflow Systems.**

- Task H26. Complete Airframe and Powerplant Development course.
- Task H27. Complete Airframe and Powerplant Development course.

- Task H28. Complete Airframe and Powerplant Development course.

#### **I. Engine Cooling Systems.**

- Task I29. Complete Airframe and Powerplant Development course.
- Task I30. Complete Airframe and Powerplant Development course.

#### **J. Engine Exhaust System Components.**

- Task J31. Complete Airframe and Powerplant Development course. Member is required to assist on an engine overhaul in the engine shop or complete an engine intermediate maintenance-training course.
- Task J32a. Complete Airframe and Powerplant Development course. Member is required to assist on an engine overhaul in the engine shop or complete an engine intermediate maintenance-training course.
- Task J32b. Complete Airframe and Powerplant Development course.

#### **K. Propellers.**

- Task K33. Complete Airframe and Powerplant Development course. Complete Delta CBT
- Task K34. Complete Airframe and Powerplant Development course. Complete Delta CBT
- Task K35. Complete Airframe and Powerplant Development course. Complete Delta CBT
- Task K36. Complete Airframe and Powerplant Development course. Complete Delta CBT.
- Task K37. Complete Airframe and Powerplant Development course. Complete Delta CBT.
- Task K38. Complete Airframe and Powerplant Development course. Complete Delta CBT.
- Task K39. Complete Airframe and Powerplant Development course. Complete Delta CBT.

#### **L. Auxiliary Power Units.**

- Task L40. Not applicable.

#### **M. Aviation Safety.**

- Task M41. Complete Airframe and Powerplant Development course.
- Task M42. Complete Airframe and Powerplant Development course.
- Task M43. Complete Airframe and Powerplant Development course.
- Task M44. Complete Airframe and Powerplant Development course.
- Task M45. Complete Airframe and Powerplant Development course.

- Task M46. Complete Airframe and Powerplant Development course.
- Task M47. Complete Airframe and Powerplant Development course.
- Task M48. Complete Airframe and Powerplant Development course.
- Task M49. Complete Airframe and Powerplant Development course.
- Task M50. Complete Airframe and Powerplant Development course

**Attachment #3 – Generic CG-G-EAE-2 (10/99) FAA CERTIFICATION PERFORMANCE OF  
JOB TASKS form**

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## FAA CERTIFICATION PERFORMANCE OF JOB TASKS

Applicant's Last Name:                      First Name:                      Middle Initial:                      SSN:

GYSgt Example,	Weldon	J.	675-75-0123
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Military Job Classification:

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Military Job Classification Description Title:

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### NOTES:

1. Federal Aviation Regulation Training Levels.

FAR LEVEL 1 = Know basic facts and principles. Be able to find information, and follow directions and written instructions. Skill demonstration is **not** required.

FAR LEVEL 2 = Know and understand principles, theories and concepts. Be able to find and interpret information and perform basic operations. A high level of skill is **not** required.

FAR LEVEL 3 = Know, understand, and apply facts, principles, theories and concepts. Understand how they relate to the total operation and maintenance of aircraft. Be able to make independent and accurate airworthiness judgments. Perform all operations to a return-to-service standard. A fairly high skill level **is** required.

2. Only a certified A&P mechanic, E-6 or above (military), or a WG-10 or above (civilian), qualified in the appropriate specialty, can verify completion of a task. (Example: Propulsion specialist for powerplant, etc.)

3. Authorized Final Approving Authorities:

Army: Production Control Officer  
Air Force: Aircraft Maintenance Officer (O-3 or above)  
Navy: Maintenance Officer  
Coast Guard: Engineering Officer  
Marines: Aircraft Maintenance Officer

I certify that \_\_\_\_\_ has successfully satisfied the established FAA requirements for the Airframe, Powerplant, or Airframe and Powerplant Certificates, including a total of \_\_\_\_\_ months of combined experience while performing the duties within the career field of aviation maintenance (**Note 3**).

Signature of Maintenance Officer \_\_\_\_\_ Date \_\_\_\_\_

Unit \_\_\_\_\_

## FAA CERTIFICATION PERFORMANCE OF JOB TASKS

**Applicant's Last Name:**

**First Name:****Middle Initial:**

SSN:

**GYSgt Example,**

Weldon

---

**J.**

**675-75-0123**

I certify that I am qualified in the specialties I have initialed and the applicant has completed all formal and or on-the-job training requirements for each task (**Note 2**).

[illegible]

Signature of Maintenance Officer \_\_\_\_\_ Date \_\_\_\_\_

Unit



GENERAL CURRICULUM SUBJECTS Appendix B		FAR LEVEL (Note 1)	Formal Trng Initials	Completion Date	OJT Initials	Completion Date
<b>A. BASIC ELECTRICITY</b>						
*1. Calculate and measure capacitance and inductance	(2)					
*2. Calculate and measure electrical power	(2)					
*3. Measure voltage, current, resistance, and continuity	(3)					
*4. Determine the relationship of voltage, current, and	(3)					
*5. Read and interpret aircraft electrical circuit diagrams,	(3)					
*6. Inspect and service batteries	(3)					
<b>B. Aircraft Drawings</b>						
*7. Use aircraft drawings, symbols, and system schematics	(2)					
*8. Draw sketches of repairs and alterations	(3)					
*9. Use blueprint information	(3)					
*10. Use graphs and charts	(3)					
<b>C. WEIGHT AND BALANCE</b>						
11. Weigh aircraft	(2)					
*12. Perform complete weight and balance check and record	(3)					
<b>D. Fluid Lines and Fittings</b>						
*13. Fabricate and install rigid and flexible fluid lines and fittings	(3)					
<b>E. Materials and Processes</b>						
*14. Identify and select appropriate non-destructive testing	(1)					
*15. Perform dye penetrant, eddy current, ultrasonic, and	(2)					
*16. Perform basic heat-treating processes	(1)					
*17. Identify and select aircraft hardware and materials	(3)					
*18. Inspect and check welds	(3)					
*19. Perform precision measurements	(3)					
<b>F. Ground Operation and Servicing</b>						
*20. Start, ground operate, move, service, and secure aircraft	(2)					
*21. Identify and select fuels	(2)					
<b>G. Cleaning and Corrosion Control</b>						
*22. Identify and select cleaning materials	(3)					
*23. Inspect, identify, remove, and treat aircraft corrosion and	(3)					
<b>H. Mathematics</b>						
*24. Extract roots and raise numbers to a given power	(3)					
*25. Determine areas and volumes of various geometrical	(3)					
*26. Solve ratio, proportion, and percentage problems	(3)					
*27. Perform algebraic operations involving addition, subtraction, multiplication, and division of positive and negative numbers	(3)					

EXAMPLE ONLY

**EXAMPLE ONLY**

<b>GENERAL CURRICULUM SUBJECTS Appendix B</b>		FAR LEVEL (Note 1)	Formal Trng Initials	Completion Date	OJT Initials	Completion Date
<b>I. MAINTENANCE FORMS AND RECORDS</b>						
*28. Write descriptions of work performed, including aircraft	(3)					
*29. Complete required maintenance forms, records, and	(3)					
<b>J. Basic Physics</b>						
*30. Use and understand the principles of simple machines; sound, fluid, and heat dynamics; basic aerodynamics; aircraft structures; and theory of flight	(2)					
<b>K. Maintenance Publications</b>						
*31. Demonstrate ability to read, comprehend, and apply information contained in FAA and manufacturers' aircraft maintenance specifications, data sheets, manuals, publications, and related Federal Aviation Regulations, Airworthiness Directives, and Advisory materials	(3)					
*32. Read technical data	(3)					
<b>L. Mechanic Privileges and Limitations</b>						
*33. Exercise mechanic privileges within the limitations	(3)					
<b>AIRFRAME CURRICULUM SUBJECTS Appendix C</b>		FAR LEVEL (Note 1)	Formal Trng Initials	Completion Date	OJT Initials	Completion Date
<b>I. AIRFRAME STRUCTURES</b>						
<b>A. Wood Structures</b>						
1. Service and repair wood structures	(1)					
2. Identify wood defects	(1)					
3. Inspect wood structures	(1)					
<b>B. Aircraft Covering</b>						
4. Select and apply fabric and fiberglass covering materials	(1)					
5. Inspect, test, and repair fabric and fiberglass	(1)					
<b>C. Aircraft Finishes</b>						
6. Apply trim, letters, and touchup paint	(1)					
7. Identify and select aircraft finishing materials	(2)					
8. Apply finishing materials	(2)					
*9. Inspect finishes and identify defects	(2)					

EXAMPLE ONLY

**EXAMPLE ONLY**

<b>AIRFRAME CURRICULUM SUBJECTS Appendix C</b>	<b>FAR LEVEL (Note 1)</b>	<b>Formal Trng Initials</b>	<b>Completion Date</b>	<b>OJT Initials</b>	<b>Completion Date</b>
<b>D. Sheet Metal and Non-Metallic Structures</b>					
*10. Select, install, and remove special fasteners for metallic,	(2)				
*11. Inspect bonded structures	(2)				
*12. Inspect, test, and repair fiberglass, plastics, honeycomb,	(2)				
*13. Inspect, check, service, and repair windows, doors, and	(2)				
*14. Inspect and repair sheet-metal structures	(3)				
*15. Install conventional rivets	(3)				
*16. Form, lay out, and bend sheet-metal	(3)				
<b>E. Welding</b>					
17. Weld magnesium and titanium	(1)				
18. Solder stainless steel	(1)				
19. Fabricate tubular structures	(1)				
*20. Solder, braze, gas-weld, and arc-weld steel	(2)				
21. Weld aluminum and stainless steel	(1)				
<b>F. Assembly and Rigging</b>					
*22. Rig rotary-wing aircraft	(1)				
*23. Rig fixed-wing aircraft	(2)				
*24. Check alignment of structures	(2)				
*25. Assemble aircraft components, including flight control	(3)				
*26. Balance, rig and inspect movable primary and secondary	(3)				
*27. Jack aircraft	(3)				
<b>G. Airframe Inspection</b>					
*28. Perform airframe conformity and airworthiness inspections	(3)				
<b>II. AIRFRAME SYSTEMS AND COMPONENTS</b>					
<b>A. Aircraft Landing Gear Systems</b>					
*29. Inspect, check, service, and repair landing gear, retraction	(3)				
<b>B. Hydraulic and Pneumatic Power Systems</b>					
*30. Repair hydraulic and pneumatic power system	(2)				
*31. Identify and select hydraulic fluids	(3)				
*32. Inspect, check, service, troubleshoot, and repair hydraulic	(3)				
<b>C. Cabin Atmosphere Control Systems</b>					
*33. Repair heating, cooling, air-conditioning, pressurization,	(1)				
*34. Inspect, check, troubleshoot, service, and repair heating,	(1)				
*35. Inspect, check, troubleshoot, service, and repair oxygen	(2)				

**EXAMPLE ONLY**

**EXAMPLE ONLY**

<b>AIRFRAME CURRICULUM SUBJECTS Appendix C</b>	<b>FAR LEVEL (Note 1)</b>	<b>Formal Trng Initials</b>	<b>Completion Date</b>	<b>OJT Initials</b>	<b>Completion Date</b>
<b>D. Aircraft Instrument Systems</b>					
*36. Inspect, check, service, troubleshoot, and repair electronic	(1)				
*37. Install instruments and perform a static pressure system	(2)				
<b>E. COMMUNICATION AND NAVIGATION SYSTEMS</b>					
*38. Inspect, check, and troubleshoot autopilot, servos and approach coupling systems	(1)				
*39. Inspect, check, and service aircraft electronic communication and navigation systems, including VHF, passenger address interphones and static discharge devices, aircraft VOR, ILS, LORAN, radar beacon transponders, flight management computers and GPWS	(1)				
*40. Inspect and repair antenna and electronic equipment installations	(2)				
<b>F. Aircraft Fuel Systems</b>					
*41. Check and service fuel dump systems	(1)				
*42. Perform fuel management, transfer and defueling	(1)				
*43. Inspect, check, and repair pressure fueling systems	(1)				
*44. Repair aircraft fuel system components	(2)				
*45. Inspect and repair fluid quantity indicating systems	(2)				
*46. Troubleshoot, service, and repair fluid pressure and temperature warning systems	(2)				
*47. Inspect, check, service, troubleshoot, and repair aircraft fuel systems	(3)				
<b>G. Aircraft Electrical Systems</b>					
*48. Repair and inspect aircraft electrical system components; crimp and splice wiring to manufacturers' specifications; and repair pins and sockets of aircraft connectors	(2)				
*49. Install, check, and service airframe electrical wiring, controls, switches, indicators and protective devices	(3)				
*50a. Inspect, check, troubleshoot, service, and repair alternating and direct current electrical systems	(3)				
*50b. Inspect, check, and troubleshoot constant speed and integrated speed drive generators	(1)				
<b>H. Position and Warning Systems</b>					
*51. Inspect, check, and service speed and configuration warning systems, electrical brake controls, and anti-skid systems	(2)				
*52. Inspect, check, troubleshoot, and service landing gear position indicating and warning systems	(3)				
<b>I. Ice and Rain Control Systems</b>					
*53. Inspect, check, troubleshoot, service, and repair airframe ice and rain control systems	(2)				

**EXAMPLE ONLY**

**EXAMPLE ONLY**

<b>AIRFRAME CURRICULUM SUBJECTS Appendix C</b>		FAR LEVEL (Note 1)	Formal Trng Initials	Completion Date	OJT Initials	Completion Date
<b>J. Fire Protection Systems</b>						
*54. Inspect, check, and service smoke and carbon monoxide detection systems	(1)					
*55. Inspect, check, troubleshoot, and repair aircraft fire detection and extinguishing systems	(3)					
<b>POWERPLANT CURRICULUM SUBJECTS Appendix D</b>						
<b>I. POWERPLANT THEORY AND MAINTENANCE</b>						
<b>A. Reciprocating Engines</b>						
1. Inspect and repair a radial engine	(1)					
2. Overhaul reciprocating engines	(2)					
3. Inspect, check, service, and repair reciprocating engines and engine installations	(3)					
4. Install, troubleshoot, and remove reciprocating engines	(3)					
<b>B. Turbine Engines</b>						
*5. Overhaul turbine engines	(2)					
*6. Inspect, check, service, and repair turbine engines and turbine engine installations	(3)					
*7. Install, troubleshoot, and remove turbine engines	(3)					
<b>C. Engine Inspection</b>						
*8. Perform powerplant conformity and airworthiness inspections	(3)					
<b>II. POWERPLANT SYSTEMS AND COMPONENTS</b>						
<b>A. Engine Instrument Systems</b>						
*9. Troubleshoot, service, and repair electrical and mechanical fluid rate-of-flow indicating systems	(2)					
*10. Inspect, check, service, troubleshoot, and repair electrical and mechanical engine temperature, pressure, and R.P.M. indicating systems	(3)					
<b>B. Engine Fire Protection Systems</b>						
*11. Inspect, check, service, troubleshoot, and repair engine fire detection and extinguishing systems	(3)					
<b>C. Engine Electrical Systems</b>						
*12. Repair engine electrical system components	(2)					
*13. Install, check, and service engine electrical wiring, controls, switches, indicators, and protective devices	(3)					

**EXAMPLE ONLY**

**EXAMPLE ONLY**

<b>POWERPLANT CURRICULUM SUBJECTS Appendix D</b>	<b>FAR LEVEL (Note 1)</b>	<b>Formal Trng Initials</b>	<b>Completion Date</b>	<b>OJT Initials</b>	<b>Completion Date</b>
<b>D. ENGINE LUBRICATING SYSTEMS</b>					
*14. Identify and select lubricants	(2)				
*15. Repair engine lubrication system components	(2)				
*16. Inspect, check, service, troubleshoot, and repair engine lubrication systems	(3)				
<b>E. IGNITION AND STARTING SYSTEMS</b>					
*17. Overhaul magnetos and ignition harnesses	(1)				
*18. Inspect, service, troubleshoot, and repair reciprocating and turbine engine ignition systems and components	(2)				
*19a. Inspect, service, troubleshoot, and repair turbine engine electrical starting systems	(3)				
*19b. Inspect, service, and troubleshoot turbine engine pneumatic starting systems	(1)				
<b>F. Fuel Metering Systems</b>					
*20. Troubleshoot and adjust turbine engine fuel metering systems and electronic engine fuel controls	(1)				
*21. Overhaul carburetors	(1)				
*22. Repair engine fuel metering system components	(2)				
*23. Inspect, check, service, troubleshoot, and repair reciprocating and turbine engine fuel metering systems	(3)				
<b>G. Engine Fuel Systems</b>					
*24. Repair engine fuel system components	(2)				
*25. Inspect, check, service, troubleshoot, and repair engine fuel systems	(3)				
<b>H. Induction and Airflow Systems</b>					
*26. Inspect, check, troubleshoot, service, and repair engine ice and rain control systems	(1)				
*27. Inspect, check, troubleshoot, service, and repair heat exchangers, supercharger and turbine engine airflow and temperature control systems	(1)				
*28. Inspect, check, service, and repair carburetor air intake and induction manifolds	(1)				
<b>I. Engine Cooling Systems</b>					
*29. Repair engine cooling system components	(1)				
*30. Inspect, check, troubleshoot, service, and repair engine cooling systems	(1)				
<b>J. Engine Exhaust System Components</b>					
*31. Repair engine exhaust system components	(2)				
*32a. Inspect, check, troubleshoot, service, and repair engine exhaust systems	(3)				
*32b. Troubleshoot and repair engine thrust reverser systems and related components	(1)				

**EXAMPLE ONLY**

<b>POWERPLANT CURRICULUM SUBJECTS Appendix D</b>	<b>FAR LEVEL (Note 1)</b>	<b>Formal Trng Initials</b>	<b>Completion Date</b>	<b>OJT Initials</b>	<b>Completion Date</b>
<b>K. Propellers</b>					
*33. Inspect, check, service, and repair propeller synchronizing and ice control systems	(1)				
*34. Identify and select propeller lubricants	(2)				
*35. Balance propellers	(1)				
*36. Repair propeller control system components	(2)				
*37. Inspect, check, service, and repair fixed-pitch, constant-speed, and feathering propellers and propeller governing systems	(3)				
*38. Install, troubleshoot, and remove propellers	(3)				
*39. Repair aluminum alloy propeller blades	(3)				
<b>L. Auxiliary Power Units</b>					
40. Inspect, check, service and troubleshoot turbine-driven auxiliary power units	(2)				
<b>M. Aviation Safety</b>					
*41. Fuels, lubricants, or hydraulic fluids	(1)				
*42. Flammable cements, rosins, sealants, paints and thinners	(1)				
*43. Fluids under pressure	(1)				
*44. Compressed gasses, including oxygen	(1)				
*45. Batteries	(1)				
*46. Aviation ordnance and pyrotechnics	(1)				
*47. Electrical and electronic circuits	(1)				
*48. Operating radio transmitters and radar systems	(1)				
*49. Hazardous noise sources	(1)				

NOTE: Items with an asterisk (\*) indicate a mandatory task to be accomplished. Non-asterisked items are optional tasks and do not require a signature, but the information is testable on the computerized written exams, as well as the oral and practicals.

EXAMPLE ONLY

## **UNIT 1. MATHEMATICS**

### ***INTRODUCTION***

The use of mathematics is so woven into every area of everyday life that seldom if ever does one fully realize how very helpless we would be in the performance of most of our daily work without the knowledge of even the simplest form of mathematics. Many persons have difficulty with relatively simple computations involving only elementary mathematics. Performing mathematical computations with success requires an understanding of the correct procedures and continued practice in the use of mathematical manipulations.

A person entering the aviation field will be required to perform with accuracy. The aviation mechanic is often involved in tasks that require mathematical computations of some sort. Tolerances in aircraft and engine components are often critical, making it necessary to measure within a thousandth or ten-thousandth of an inch. Because of the close tolerances to which he must adhere, it is important that the aviation mechanic be able to make accurate measurements and mathematical calculations.

Mathematics may be thought of as a kit of tools, each mathematical operation being compared to the use of one of the tools in the solving of a problem. The basic operations of addition, subtraction, multiplication, and division are the tools available to aid us in solving a particular problem.

### **1-1 Basic Math**

#### **001. Whole Numbers**

##### ***Addition of Whole Numbers***

The process of finding the combined amount of two or more numbers is called addition. The answer is called the sum.

When adding several whole numbers, such as 4567, 832, 93122, and 65, place them under each other with their digits in columns so that the last, or right hand, digits are in the same column.

When adding decimals such as 45.67, 8.32, 9.8122, and .65, place them under each other so that the decimal points are in a straight “up-and- down” line.

To check addition, either add the figures again in the same order, or add them in reverse order.

##### ***Subtraction of Whole Numbers***

Subtraction is the process of finding the difference between two numbers by taking the smaller from the larger of the two numbers. The number which is subtracted is called the subtrahend, the other number the minuend, and their difference is called the remainder. To find the remainder, write the subtrahend under the minuend, as in addition. Beginning at the right, subtract each figure in the subtrahend from the figure above it and write the individual remainder below in the same column. When the process is completed, the number below the subtrahend is the remainder.

To check subtraction, add the remainder and the subtrahend together. The sum of the two should equal the minuend.

##### ***Multiplication of Whole Numbers***

The process of finding the quantity obtained by repeating a given number a specified number of times is called multiplication. More simply stated, the process of multiplication is, in effect, a case of repeated addition in which all the numbers being added are identical. Thus, the sum of



$6 + 6 + 6 + 6 = 24$  can be expressed by multiplication as  $6 \times 4 = 24$ . The numbers 6 and 4 are known as the factors of the multiplication, and 24 as the product.

In multiplication, the product is formed by multiplying the factors. When one of the factors is a single-digit integer (whole number), the product is formed by multiplying the single-digit integer with each digit of the other factor from right to left, carrying when necessary.

When both factors are multiple, digit integers, the product is formed by multiplying each digit in the multiplying factor with the other factor. Exercise care, when writing down the partial products formed, to make certain that the extreme right digit lines up under the multiplying digit. It is then a matter of simple addition to find the final product.

EXAMPLE:

Determine the cost of 18 spark plugs that cost \$3.25 each.

$$\begin{array}{r} 3.25 \\ \times 18 \\ \hline 2600 \\ 3250 \\ \hline 58.50 \end{array}$$

When multiplying a series of numbers together, the final product will be the same regardless of the order in which the numbers are arranged.

EXAMPLE:

MULTIPLY:  $(7)(3)(5)(2) = 210$

$$\begin{array}{ccc} 7 & 21 & 105 \\ \times 3 & \times 5 & \times 2 \\ \hline 21 & 105 & 210 \end{array} \quad \text{or} \quad \begin{array}{ccc} 7 & 3 & 25 \\ \times 5 & \times 2 & \times 6 \\ \hline 35 & 6 & 210 \end{array}$$

### ***Division of Whole Numbers***

The process of finding how many times one number is contained in a second number is called division. The first number is called the divisor, the second the dividend, and the result is the quotient.

Of the four basic operations with integers, division is the only one that involves trial and error in its solution. It is necessary to guess at the proper quotient digits, and though experience will tend to lessen the number of trials, everyone will guess incorrectly at some time or another.

Placing the decimal point correctly in the quotient quite often presents a problem. When dividing a decimal by a decimal, an important step is to first remove the decimal from the divisor. This is accomplished by shifting the decimal point to the right the number of places needed to eliminate it. Next, move the decimal point to the right as many places in the dividend as was necessary to move it in the divisor, and then proceed as in ordinary division.

## **002. FRACTIONS**

A fraction is an indicated division that expresses one or more of the equal parts into which a unit is divided. For example, the fraction  $\frac{2}{3}$  indicates that the whole has been divided into 3 equal parts and that 2 of these parts are being used or considered. The number above the line is the numerator; and the number below the line is the denominator.

If the numerator of a fraction is equal to or larger than the denominator, the fraction is known as an improper fraction. In the fraction  $15/8$ , if the indicated division is performed, the improper fraction is changed to a mixed number, which is a whole number and a fraction:

$$\frac{15}{8} = 1\frac{7}{8}$$

A complex fraction is one that contains one or more fractions or mixed numbers in either the numerator or denominator. The following fractions are examples:

$$\frac{\frac{1}{2}}{\frac{2}{3}}, \quad \frac{\frac{5}{8}}{\frac{2}{3}}, \quad \frac{\frac{3}{4}}{\frac{5}{8}}, \quad 3\frac{1}{\frac{2}{3}}$$

A decimal fraction is obtained by dividing the numerator of a fraction by the denominator and showing the quotient as a decimal. The fraction  $5/8$  equals  $5 \div 8 = .625$ .

A fraction does not change its value if both numerator and denominator are multiplied or divided by the same number.

$$\frac{1}{4} \times \frac{3}{3} = \frac{3}{12} = \frac{1}{4}$$

The same fundamental operations performed with whole numbers can also be performed with fractions. These are addition, subtraction, multiplication, and division.

### ***Addition and Subtraction of Common Fractions***

In order to add or subtract fractions, all the denominators must be alike. In working with fractions, as in whole numbers, the rule of likeness applies. That is, only like fractions may be added or subtracted.

When adding or subtracting fractions that have like denominators, it is only necessary to add or subtract the numerators and express the result as the numerator of a fraction whose denominator is the common denominator. When the denominators are unlike, it is necessary to first reduce the fractions to a common denominator before proceeding with the addition or subtraction process.

EXAMPLES:

1. A certain switch installation requires  $5/8$ -inch plunger travel before switch actuation occurs. If  $1/8$ -inch travel is required after actuation, what will be the total plunger travel?

FIRST: Add the numerators.

$$5 + 1 = 6$$

NEXT: Express the result as the numerator of a fraction whose denominator is the common denominator.

$$\frac{5}{8} + \frac{1}{8} = \frac{6}{8}$$

2. The total travel of a jackscrew is  $\frac{13}{16}$  of an inch. If the travel in one direction from the neutral position is  $\frac{7}{16}$  of an inch, what is the travel in the opposite direction?

FIRST: Subtract the numerators.

$$13 - 7 = 6$$

NEXT: Express the result as the numerator of a fraction whose denominator is the common denominator.

$$\frac{13}{16} - \frac{7}{16} = \frac{6}{16}$$

3. Find the outside diameter of a section of tubing that has a  $\frac{1}{4}$ -inch inside diameter and a combined wall thickness of  $\frac{5}{8}$  inch.

FIRST: Reduce the fractions to a common denominator.

$$\frac{1}{4} = \frac{2}{8} \qquad \frac{5}{8} = \frac{5}{8}$$

NEXT: Add the numerators, and express the result as the numerator of a fraction whose denominator is the common denominator.

$$\frac{2}{8} + \frac{5}{8} = \frac{7}{8}$$

4. The tolerance for rigging the aileron droop of an airplane is  $\frac{7}{8}$  inch plus or minus  $\frac{1}{5}$  inch. What is the minimum droop to which the aileron can be rigged?

FIRST: Reduce the fractions to a common denominator.

$$\frac{7}{8} = \frac{35}{40} \qquad \frac{1}{5} = \frac{8}{40}$$

NEXT: Subtract the numerators, and express the result as in the above examples.

$$\frac{35}{40} - \frac{8}{40} = \frac{27}{40}$$

### ***Finding the Least Common Denominator***

When the denominators of fractions to be added or subtracted are such that a common denominator cannot be determined readily, the LCD (least common denominator) can be found by the continued division method.

To find the LCD of a group of fractions, write the denominators in a horizontal row. Next, divide the denominators in this row by the smallest integer that will exactly divide two or more of the denominators. Bring down to a new row all the quotients and numbers that were not divisible. Continue this process until there are no two numbers in the resulting row that are divisible by any integer other than one. Multiply together all the divisors and the remaining terms in the last row to obtain the least common denominator.

EXAMPLE:

What is the LCD for  $\frac{7}{8}, \frac{11}{20}, \frac{8}{36}, \frac{21}{45}$ ?

FIRST: Write the denominators in a horizontal row and divide this row by the smallest integer that will exactly divide two or more of the numbers.

$$\begin{array}{r|rrrr} 2 & 8 & 20 & 36 & 45 \\ \hline & 4 & 10 & 18 & 45 \end{array}$$

NEXT: Continue this process until there are no two numbers in the resulting row that are divisible by any integer other than one.

$$\begin{array}{r|rrrr} 2 & 8 & 20 & 36 & 45 \\ \hline 2 & 4 & 10 & 18 & 45 \\ \hline 3 & 2 & 5 & 9 & 45 \\ \hline 3 & 2 & 5 & 3 & 15 \\ \hline 5 & 2 & 5 & 1 & 5 \\ \hline & 2 & 1 & 1 & 1 \end{array}$$

THEN: Multiply together all the divisors and remaining terms in the last row to obtain the LCD.

$$\text{LCD} = 2 \times 2 \times 3 \times 3 \times 5 \times 2 = 360$$

### ***Multiplication of Fractions***

The product of two or more fractions is obtained by multiplying the numerators to form the numerator of the product and by multiplying the denominators to form the denominator of the product. The resulting fraction is then reduced to its lowest terms. A common denominator need not be found for this operation, as the new denominator in most cases will be different from that of all the original fractions.

EXAMPLE:

What is the product of  $\frac{3}{5} \times \frac{12}{22} \times \frac{1}{2}$ ?

First: Multiple the numerators together.

$$3 \times 12 \times 1 = 36$$

Next: Multiply the denominators together.

$$5 \times 22 \times 2 = 220$$

Then: Reduce the resulting fraction to its lowest terms.

$$\frac{36}{220} = \frac{9}{55}$$

### **Cancellation**

Cancellation is a technique of dividing out or canceling all common factors that exist between numerators and denominators. This aids in locating the ultimate product by eliminating much of the burdensome multiplication.

EXAMPLE:

What is the product of  $\frac{18}{10} \times \frac{3}{5}$ ?

The product could be found by multiplying  $18 \times 3$  and  $10 \times 5$ , then dividing the product of the numerators by the product of the denominators. However, a much easier method of solution is by cancellation. It is apparent that the 10 in the denominator and the 5 in the numerator can both be divided an exact number of times by 5.

$$\frac{18}{10} \times \frac{3}{5} =$$

$$\frac{18}{2} \times \frac{3}{1} =$$

Also, the 18 and 3 are both exactly divisible by 3.

$$\frac{6}{2} \times \frac{1}{1} =$$

$$\frac{6}{2} \times \frac{1}{1} =$$

The resulting 6 in the numerator and the 2 in the denominator are both divisible by 2.

The fraction is thus reduced to its lowest terms, and the final multiplication and division steps are performed with ease when compared with the task of multiplying and dividing the larger fractions.

### **Division of Common Fractions**

The division of common fractions is accomplished most conveniently by converting the problem into

$$\frac{3}{6} \div \frac{1}{10} = \frac{3 \times 1}{6 \times 1} = \frac{3}{6} = \frac{1}{2}$$

a multiplication of two common fractions. To divide one fraction by another fraction, invert the divisor fraction and multiply the numerators together and the denominators together. This is known as the inverted divisor method.

Always keep in mind the order in which the fractions are written. It is important in division that the operations be performed in the order indicated. Also, remember that it is always the divisor that is inverted, never the dividend.

### **003. MIXED NUMBERS and Decimals**

#### **MIXED NUMBERS**

Mixed numbers can be added, subtracted, multiplied, or divided by changing them to improper fractions and proceeding as when performing the operations with other fractions.

EXAMPLE:

A piece of tubing  $6\frac{3}{16}$  inches long is cut from a piece  $24\frac{1}{2}$  inches long. Allowing  $\frac{1}{16}$  inch for the cut, what is the length of the remaining piece?

FIRST: Reduce the fractional parts to like fractions and complete the subtraction process.

$$\frac{1}{2} - \frac{3}{16} - \frac{1}{16} = \frac{8}{16} - \frac{3}{16} - \frac{1}{16} = \frac{4}{16} = \frac{1}{4}$$

NEXT: Subtract the integer parts.

$$24 - 6 = 18$$

THEN: Combine the results obtained in each step.

$$18 + \frac{1}{4} = 18\frac{1}{4} \text{ inches}$$

#### **DECIMALS**

Decimals are fractions whose denominators are 10 or some multiple of 10, such as 100, 1,000, 10,000, etc. They are indicated by writing one or more digits to the right of a reference mark called a decimal point. Thus:

$$\frac{6}{10} = .6 \text{ Both read as six tenths}$$

$$\frac{6}{100} = .06 \text{ Both read as six hundredths}$$

$$\frac{6}{1,000} = .006 \text{ Both read as six thousandths}$$

When writing a decimal, any number of zeros may be written at the right end without changing the value of the decimal. This may be illustrated in the following manner:

$$.5 = \frac{5}{10} = \frac{1}{2}; \quad .50 = \frac{50}{100} = \frac{1}{2}; \quad .500 = \frac{500}{1,000} = \frac{1}{2}$$

A decimal fraction that is written where there is no whole number as .6, .06, etc., is called a pure decimal. When a whole number and a decimal fraction are written together as 3.6, 12.2, 131.12, etc., the number is known as a mixed decimal.

#### **Addition of Decimals**

When computing decimals, the rule of likeness requires that we add or subtract only like denominations. This rule was discussed previously under addition and subtraction of whole numbers. To add or subtract decimal expressions, arrange the

decimals so that the decimal points align vertically, and add or subtract as with integers. Place the decimal point in the result directly below the decimal points in the addends or minuend and subtrahend.

EXAMPLES:

**Figure 1-1. A series circuit.**

The total resistance of series circuit (figure 1–1) is equal to the sum of the individual resistances. What is the total resistance for the diagram shown in this example?

FIRST: Arrange the decimals in a vertical column so that the decimal points are in alignment.

$$\begin{array}{r} 2.34 \\ 37.5 \\ .09 \end{array}$$

NEXT: Complete the addition following the technique used in adding whole numbers. Place the decimal point in the result directly below the other decimal points.

$$\begin{array}{r} 2.34 \\ 37.5 \\ \underline{.09} \\ 39.93 \text{ ohms} \end{array}$$

### *Subtraction of Decimals*

A series circuit containing two resistors has a total resistance of 37.27 ohms. One of the resistors has a value of 14.88 ohms. What is the value of the remaining resistor?

FIRST: Arrange the decimals in a vertical column so that the decimal points are in alignment.

$$\begin{array}{r} 37.27 \\ -14.88 \end{array}$$

NEXT: Perform the subtraction process using the procedure for subtracting whole numbers. Place the decimal point in the result directly below the other decimal points.

$$\begin{array}{r} 37.27 \\ - 14.88 \\ \hline 22.39 \end{array}$$

### *Multiplication of Decimals*

The multiplication of a decimal by another decimal will always produce an answer smaller than either of the two numbers. When a decimal is multiplied by a whole number or by a mixed decimal, the answer will lie between the two numbers.

When multiplying a decimal fraction by an integer or another decimal, establishing the position of the decimal point in the product causes the greatest amount of difficulty.

To multiply decimals, ignore the decimal points and multiply the terms as though they were whole numbers. To locate the decimal point in the product, begin at the right of the product and point off toward the left the number of decimal places that will equal the sum of the decimal places in the quantities multiplied.

EXAMPLE:

Using the formula, Watts = Amperes  $\times$  Voltage, what is the wattage of an electric heater that uses 9.45 amperes from a 120-volt source?

FIRST: Arrange the terms and multiply. Ignore the decimal point.

$$\begin{array}{r} 9.45 \\ \times 120 \\ \hline 000 \\ 18900 \\ \hline 94500 \\ 113400 \end{array}$$

NEXT: Locate the decimal point. Begin at the right of the product and point off toward the left the number of places that will equal the sum of the decimal places in the quantities multiplied.

$$\begin{array}{r} 9.45 \\ \times 120 \\ \hline 000 \\ 18900 \\ \hline 94500 \\ 1134.00 \end{array}$$

In some problems the number of digits in the product will be less than the sum of the decimal places in the quantities multiplied. Where this occurs, merely add zeros to the left of the product until the number of digits equals the sum of the decimal places in the quantities multiplied.

EXAMPLE:

Multiply .218 by .203.

FIRST: Arrange the terms and multiply, ignoring the decimal point.

$$\begin{array}{r} .218 \\ \times .203 \\ \hline 654 \\ \hline 43600 \\ 44254 \end{array}$$

NEXT: Locate the decimal point. Add a zero to the left of the product so that the number of places will equal the sum of the decimal places in the quantities multiplied.



$$\begin{array}{r}
 .218 \\
 \times .203 \\
 \hline
 654 \\
 43600 \\
 \hline
 .044254
 \end{array}$$

### ***Division of Decimals***

When one or both of the terms of a division problem involve decimal expressions, the quotient is found by converting the problem to one involving a whole number.

Two facts relating to division of decimals that must be borne in mind are: (1) When the dividend and divisor are multiplied by the same number, the quotient remains unchanged; and (2) if the divisor is a whole number, the decimal place in the quotient will align vertically with the decimal in the dividend when the problem is expressed in long division form.

To divide decimal expressions, count off to the right of the decimal point in the dividend the same number of places that are located to the right of the decimal point in the divisor. Insert a caret (^) to the right of the last digit counted. If the number of decimal places in the dividend is less than the number of decimal places in the divisor, add zeros to the dividend, remembering that there must be at least as many decimal places in the dividend as in the divisor. Divide the terms, disregarding the decimal points entirely. Place the decimal point in the quotient so that it aligns vertically with the caret mark in the dividend.

***This document continues on for another 40 pages...***

**Attachment #5 – Sample Certificate of Completion**

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# Certificate of Eligibility



*This document certifies that*

**Technical Sergeant John Doe 050-05-0505**



*has met the prescribed experience requirements of Federal Aviation Regulation Part 65.77, Certification: Airmen Other Than Flight Crew Members, Subpart D - Mechanics, and is recommended for authorization to be tested for:*



## ***FAA Airframe and Powerplant Mechanic***

*certification. In accordance with FAA Policy and prescribed by the Joint Services Aviation Maintenance Technician Council, this certificate was duly signed and validated on 15 June, 2000*

Estel Breeding, Jr., MSgt, USAF  
Superintendent, Aviation Technical Degree Programs  
Community College of the Air Force  
Maxwell AFB, AL 36112

\_\_\_\_\_  
Authorizing Official, Rank, Branch of Service  
Duty Title, Duty Location

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

